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Conference



2010



IEEE EDUCON 2010
IEEE Engineering Education 2010
The Future of Global Learning in Engineering Education

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April 14th - 16th, 2010, Madrid Spain





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**EDUCON 2010 – Annual Global Engineering Education Conference
The Future of Global Learning in Engineering Education.**

Promoted by the IEEE Education Society

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WELCOME FROM IEEE EDUCON 2010 CHAIRS

It is well documented that our modern society is characterized by rapid developing and ever-changing political, social, economical, technological and environmental situations. Consequently, our society of the 21st century makes great demands on its members in virtually every aspect of their lives. Members of the society must now keep pace with these mutable situations, adapt their skills and expertise with agility, collaborate, and compete to provide value to society. Technology subjects and the engineering domain are, in particular, affected by this situation.

As a result of this, educational approaches have changed over the last century from remedial repetitive learning to today's learning, which focuses on acquiring an understanding of how to become more independent in the learning process. Learning is no longer concentrated mainly in the first stages of human life through formal education and specific training in business, but it becomes a day-by-day routine over a human's life cycle. This situation requires new forms and channels in the learning process. Additionally, modern learning approaches must account for social and cultural aspects as well as the individual's profile including task and role-based aspects, interests, knowledge state, short-term learning objectives and long-term career goals. Thus processing and acquiring knowledge is a key to a modern learning pedagogy, but also content creation, collaboration and community-based practice for knowledge and skills development are important success factors.

IEEE Education Society partnership with the IEEE Region 8, is beginning a new global engineering education conference, IEEE EDUCON, held each year in selected cities throughout Europe, the Middle East, and Africa. The conference provides an interdisciplinary forum for academic, government and industrial collaboration on teaching methods, practical experiences and research toward improving the future of global engineering education. The IEEE EDUCON conference will attract participants from all over the world and will provide an interdisciplinary forum for academic, research and industrial collaboration on teaching methods, practical experiences and research towards the future of global Engineering Education.

The conference will cover papers in the categories of: research, development, evaluation and best practices that deal with learning Engineering Education in academic, organizational, and life-long learning settings including, but not limited to the following areas and their associated topics:

- Area 1: Infrastructure and Technologies for Engineering Education
- Area 2: Innovative Materials, Teaching and Learning Experiences in Engineering Education
- Area 3: Knowledge and Competencies in Engineering
- Area 4: Educational Methods and Learning Mechanisms in Engineering Education
- Area 5: Attracting, Engaging and Retaining Human Talent to Engineering

Manuel Castro (Spanish University for Distance Education, Spain), Edmundo Tovar (Technical University of Madrid, Spain) and Michael E. Auer (Carinthia Tech Institute Villach, Austria)
EDUCON 2010 Conference Chairs

IEEE EDUCON 2010 CONFERENCE PROGRAM

Wednesday, April 14th, 2010 – Madrid

CONFERENCE VENUE: UNED. Faculty of Humanities and Faculty of Sciences

Location: Campus “Senda del Rey”, close to “Puente de los Franceses”

- 9:00 - 9:30 - EDUCON 2010 Opening Ceremony
- 9:30 – 10:30 - Keynote Speaker Session – Susan Lord - IEEE Education Society: Global Leader in Engineering Education
- 11:00 - 12:00 - Session: 01A Area 4: Learning Models - Competency and Teaching methodologies
Session: 01B Area 3: Specific Engineering Disciplines - Researches
Session: 01C Area 1: Collaborative and Social Technologies - Social Computing
Session: 01D Area 1: Computer and Web based Software - Web based services
Session: 01E Area 1: Computer Supported Collaborative Learning - For use in projects
Session: 01F Area 1: Intelligent Learning Systems
Session: 01G Area 3: First Year Courses and Programs
- 12:15 - 13:15 - Session: 02A Area 3: Skills Development: Technical Writing, Presentation, Teamwork
Session: 02B Area 3: Knowledge and Competencies Management - Competencies
Session: 02C Area 2: Innovative Engineering Courses and Labs - Laboratories
Session: 02D Area 2: Laboratory Experiences: on-site and remote environments - Remote Labs
Session: 02E Area 5: Lifelong Learning and Nontraditional Students - Theories and Courses
Session: 02F Area 4: Pedagogies
Session: 02G Area 1: Learning Objects reusability and digital repositories

- 14:30 - 15:30 - Session: 03A Area 2: Innovative Competitions and Laboratories - Detectors and robotics
 Session: 03B Area 2: E-Assessment
 Session: 03C Area 4: Rethinking Pedagogy in Engineering Education
 Multidisciplinary issues
 Session: 03D Area 1: Computer and Web based Software – Physics Applications
 Session: 03E Area 1: Wireless, Mobile and Ubiquitous Technologies for Learning
 Session: 03F Area 1: Open Source, Open Standards, and Federated Systems
 Session: 03G Area 3: New Frameworks for Engineering Education
- 15:45 - 16:45 - Session: 04A Area 4: Learning Models - Learning tools
 Session: 04B Area 4: Active Learning - Project based learning
 Session: 04C Area 2: Virtual Worlds for Academic, Organizational, LifeLong Learning and training - Virtual environs
 Session: 04D Area 4: e-Assessment and new Assessment Theories and Methodologies - Methods
 Session: 04E Area 1: Computer Supported Collaborative Learning - Proposals and Methodologies
 Session: 04F Area 3: Degree Programs and Curricula
 Session: 04G Area 5: Gender Issues in Engineering Education
- 17:00 - 18:30 - Session: 05A Area 1: Learning Systems Platforms and Architectures - Platforms and Learning Tools
 Session: 05B Area 3: General Issues in Engineering Education - Improving students performance
 Session: 05C Area 2: Innovative Engineering Courses and Labs - Courses
 Session: 05D Area 1: Computer and Web based Software - Programming
 Session: 05E Universia Special Session: International Engineering Cooperation
 Session: 05F LiLa Special Session: Library of Labs - LILA Project
 Session: 05G e-Madrid Special Session- eMadrid: Research and Development of e-Learning Technologies in the Madrid Region

Thursday, April 15th, 2010 – Avila

CONFERENCE VENUE: Avila's Conference Center (Centro de Congresos y Exposiciones Lienzo Norte de Ávila)

Location: Avenida de Madrid, 102 - 05001 Ávila

9:30 - 10:30 - Session: 06A Area 1: Uses of Technology in the Classroom – Engineering Applications

Session: 06B Area 3: Specific Engineering Disciplines - Practical projects in Engineering

Session: 06C Area 1: Collaborative and Social Technologies Experiences

Session: 06D ICOPER Special Session: Assessing Assessment Formats - ICOPER Network

11:00 - 12:00 - Session: 07A Area 2: Innovative Competitions and Laboratories - Digital, Communication and analytic issues

Session: 07B Area 3: Knowledge and Competencies Management - Knowledge

Session: 07C Area 4: Rethinking Pedagogy in Engineering Education - Project based learning and research

Session: 07D Area 2: Laboratory Experiences: on-site and remote environments - On-line Labs

Session: 07E Area 5: Attracting and Retaining practices in Engineering Education

12:15 - 13:15 - Session: 08A Area 1: Learning Systems Platforms and Architectures – Virtual and Remote Labs

Session: 08B Area 4: Active Learning - Methodologies and analytic studies

Session: 08C Area 2: Design Experiences - Subject methodologies in design

Session: 08D Area 3: General Issues in Engineering Education – Innovative Experiences

13:45 - 14:30 - Keynote Speaker Session – Patricia Manson - Learning in the 21st century: Technology-Enhanced Learning and European research

14:30 - 14:45 - EDUCON Awards Ceremony

IEEE EDUCON 2010 Meritorious Service Award - Dr. Russel Meier

IEEE Education Society Chapter Achievement Award 2009 - Portugal Chapter -
Jose Salvado, Jose Carlos Metrolho, Co-Chairs

Friday, April 16th, 2010 – Madrid

CONFERENCE VENUE: UPM. School of Forestry Engineering and UPM's Central Headquarters

Location: Campus of “Ciudad Universitaria”

9:30 - 10:30 - Session: 09A Area 1: Uses of Technology in the Classroom - Learning Experiences

Session: 09B Area 4: Active Learning - Collaborative learning

Session: 09C Area 1: Collaborative and Social Technologies - Collaborative and projects works

Session: 09D Area 4: e-Assessment and new Assessment Theories and Methodologies - Theories

Session: 09E OCW-Universia Special Session: OCW and Open Educational Resources

Session: 09F VISIR Special Session: Workshop on VISIR electrical and electronic remote lab: Principles and educational view

11:00 - 12:00 - Session: 10A Area 1: Adaptive and Personalized Technology-Enhanced Learning

Session: 10B Area 3: Specific Engineering Disciplines - Professional Developments

Session: 10C Area 2: Virtual Worlds for Academic, Organizational, Lifelong Learning and training - Virtual media and tools

Session: 10D Telefónica Special Session: Telefonica University Chairs Network

Session: 10E Area 5: Lifelong Learning and Nontraditional Students - Practical experiences

Session: 10F VISIR Special Session: Practical Workshop on VISIR electric and electronic remote labs

12:15 - 13:15 - Session: 11A Area 4: Learning Models - Methods

Session: 11B Area 3: General Issues in Engineering Education - Theories and studies about learning layouts

Session: 11C Area 2: Design Experiences - Tools and procedures

Session: 11D Area 1: Computer and Web Software - Security and Data Bases

Session: 11E ANECA Special Session: New Directions in Engineering Accreditation, Quality and Course Design

Session: 11F Area 2: Laboratory Experiences: on-site and remote environments - Didactics for experimentation

13:15 – 13:45 - Keynote Speaker Session – Javier Uceda - Innovation in Engineering Education

14:30 – 15:00 - Educon Closing Ceremony and Awards

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Location

Wednesday 14, Madrid

CONFERENCE VENUE: UNED. Faculty of Humanities and Faculty of Sciences

Location: Campus “Senda del Rey”, close to “Puente de los Franceses”

Thursday 15, Ávila

CONFERENCE VENUE: Avila's Conference Center (Centro de Congresos y Exposiciones
Lienzo Norte de Ávila)

Location: Avenida de Madrid, 102 - 05001 Ávila

Friday 16, Madrid

CONFERENCE VENUE: UPM. School of Forestry Engineering and UPM's Central
Headquarters

Location: Campus of “Ciudad Universitaria”

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IEEE EDUCON 2010 Areas and Topics

Areas

- **Area 1:** Infrastructure and Technologies for Engineering Education
- **Area 2:** Innovative Materials, Teaching and Learning Experiences in Engineering Education
- **Area 3:** Knowledge and Competencies in Engineering
- **Area 4:** Educational Methods and Learning Mechanisms in Engineering Education
- **Area 5:** Attracting, Engaging and Retaining Human Talent to Engineering

Area 1: Infrastructure and Technologies for Engineering Education

- Learning Systems Platforms and Architectures
- Adaptive and Personalized Technology-Enhanced Learning
- Intelligent Learning Systems
- Computer Supported Collaborative Learning
- Open Source, Open Standards, and Federated Systems
- Standardization, Reusability and Interoperability Issues
- Learning Objects reusability and digital repositories
- Experiences in OpenCourseWare Engineering Education
- Computer and Web based Software
- Uses of Technology in the Classroom
- Semantic Web and Ontologies for Learning Systems
- Web 2.0 and Social Computing for Learning and Knowledge Sharing
- Data Mining and Web Mining in Education
- Collaborative and Social Technologies
- Synchronous and Asynchronous Technologies
- Wireless, Mobile and Ubiquitous Technologies for Learning
- Ambient Intelligence and Smart Environments for Learning
- Standardization, Reusability and Interoperability Issues

Area 2: Innovative Materials, Teaching and Learning Experiences in Engineering Education

- Laboratory Experiences: on-site and remote environments
- Undergraduate Research Experiences
- Design Experiences
- Innovative Engineering Courses and Labs
- Digital Game and Intelligent Toy Enhanced Learning
- Affective and Pervasive Computing for Learning
- Human-Centered Web Science and its Applications to Technology-enhanced Learning
- E-Assessment
- Virtual Worlds for Academic, Organizational, Life-long Learning and training
- Innovative Competitions and Laboratories

Area 3: Knowledge and Competencies in Engineering

- Knowledge and Competencies Management
- Accreditation Issues
- Assessment and Feedback
- Degree Programs and Curricula
- First Year Courses and Programs
- General Issues in Engineering Education
- Specific Engineering Disciplines
- Faculty Development
- Globalization: Preparing Faculty and Students
- Graduate Curricula and Programs
- New Frameworks for Engineering Education
- Skills Development: Technical Writing, Presentation, Teamwork

Area 4: Educational Methods and Learning Mechanisms in Engineering Education

- Rethinking Pedagogy in Engineering Education
- e-Assessment and new Assessment Theories and Methodologies
- Active Learning
- Learning Models
- Pedagogies

Area 5: Attracting, Engaging and Retaining Human Talent to Engineering

- Lifelong Learning and Nontraditional Students
- E-learning in the Workplace
- K-12 Initiatives and Partnerships
- Study Abroad Programs
- Attracting and Retaining practices in Engineering Education
- Technology Enhanced Learning for students with special needs
- Accessibility in On-Line and Technology Enhanced Learning
- Gender Issues in Engineering Education
- Cultural Issues in Engineering Education
- Attracting Women to the Engineering Profession

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EDUCON CONFERENCES AND THE FUTURE

The Engineering Education Conference (EDUCON) will provide an interdisciplinary forum for academic, research and industrial collaboration on teaching methods, practical experiences and research towards the future of global Engineering Education attracting 200+ participants from all over the world. Participants will include university presidents, college deans, department chairpersons, faculty in engineering and engineering technology, and industry leaders from throughout the IEEE Region 8 (Europe, Middle East and Africa) and the world.

IEEE EDUCON conferences are organized from the IEEE Education Society in collaboration with academic and professional entities of IEEE Region 8 (Europe, Middle East and Africa). For this reason the conference is expected to yearly move around IEEE Region 8 (2010 in Europe, 2011 in Middle East and 2012 in Africa, beginning again in 2013 in Europe).

IEEE EDUCON 2011

Amman, Jordan

IEEE EDUCON 2011 will be organized by Princess Sumaya University of Technology.

Chairs: Abdullah Y. Al-Zoubi, Michael Auer and Edmundo Tovar

IEEE EDUCON 2012

Africa

TOPICS AND SESSION CODES IN EDUCON 2010

The papers presented in EDUCON 2010 Conference, have been organized in the following development areas and topics, mainly based in technical and educational resources. Every session has been addressed by a wide knowledge and extense experience chair.

<u>Session</u>	<u>Topic and Area</u>
01A	Area 4: Learning Models - Competency and Teaching methodologies
01B	Area 3: Specific Engineering Disciplines - Researches
01C	Area 1: Collaborative and Social Technologies - Social Computing
01D	Area 1: Computer and Web based Software - Web based services
01E	Area 1: Computer Supported Collaborative Learning - For use in projects
01F	Area 1: Intelligent Learning Systems
01G	Area 3: First Year Courses and Programs
02A	Area 3: Skills Development: Technical Writing, Presentation, Teamwork
02B	Area 3: Knowledge and Competencies Management - Competencies
02C	Area 2: Innovative Engineering Courses and Labs - Laboratories
02D	Area 2: Laboratory Experiences: on-site and remote environments - Remote Labs
02E	Area 5: Lifelong Learning and Nontraditional Students - Theories and Courses
02F	Area 4: Pedagogies
02G	Area 1: Learning Objects reusability and digital repositories
03A	Area 2: Innovative Competitions and Laboratories - Detectors and robotics
03B	Area 2: E-Assessment
03C	Area 4: Rethinking Pedagogy in Engineering Education - Multidisciplinary issues
03D	Area 1: Computer and Web based Software - Physics Applications
03E	Area 1: Wireless, Mobile and Ubiquitous Technologies for Learning
03F	Area 1: Open Source, Open Standards, and Federated Systems
03G	Area 3: New Frameworks for Engineering Education
04A	Area 4: Learning Models - Learning tools
04B	Area 4: Active Learning - Project based learning

<u>Session</u>	<u>Topic and Area</u>
04C	Area 2: Virtual Worlds for Academic, Organizational, Life-long Learning and training - Virtual Environs
04D	Area 4: e-Assessment and new Assessment Theories and Methodologies - Methods
04E	Area 1: Computer Supported Collaborative Learning - Proposals and Methodologies
04F	Area 3: Degree Programs and Curricula
04G	Area 5: Gender Issues in Engineering Education
05A	Area 1: Learning Systems Platforms and Architectures - Platforms and Learning Tools
05B	Area 3: General Issues in Engineering Education - Improving students performance
05C	Area 2: Innovative Engineering Courses and Labs - Courses
05D	Area 1: Computer and Web based Software - Programming
05E	Universia Special Session: International Engineering Cooperation
05F	LiLa Special Session: Library of Labs - LILA Project
05G	e-Madrid Special Session- eMadrid: Research and Development of e-Learning Technologies in the Madrid Region
06A	Area 1: Uses of Technology in the Classroom - Engineering Applications
06B	Area 3: Specific Engineering Disciplines - Practical projects in Engineering
06C	Area 1: Collaborative and Social Technologies - Experiences
06D	ICOPER Special Session: Assessing Assessment Formats - ICOPER Network
07A	Area 2: Innovative Competitions and Laboratories - Digital, Communication and analytic issues
07B	Area 3: Knowledge and Competencies Management - Knowledge
07C	Area 4: Rethinking Pedagogy in Engineering Education - Project based learning and research
07D	Area 2: Laboratory Experiences: on-site and remote environments - On-line Labs
07E	Area 5: Attracting and Retaining practices in Engineering Education
08A	Area 1: Learning Systems Platforms and Architectures - Virtual and Remote Labs
08B	Area 4: Active Learning - Methodologies and analytic studies

<u>Session</u>	<u>Topic and Area</u>
08C	Area 2: Design Experiences - Subject methodologies in design
08D	Area 3: General Issues in Engineering Education - Innovative Experiences
09A	Area 1: Uses of Technology in the Classroom - Learning Experiences
09B	Area 4: Active Learning - Collaborative learning
09C	Area 1: Collaborative and Social Technologies - Collaborative and projects works
09D	Area 4: e-Assessment and new Assessment Theories and Methodologies - Theories
09E	OCW-Universia Special Session: OCW and Open Educational Resources
09F	VISIR Special Session: Workshop on VISIR electrical and electronic remote lab: Principles and educational view
10A	Area 1: Adaptive and Personalized Technology-Enhanced Learning
10B	Area 3: Specific Engineering Disciplines - Professional Developments
10C	Area 2: Virtual Worlds for Academic, Organizational, Life-long Learning and training - Virtual media and tools
10D	Telefónica Special Session: Telefonica University Chairs Network
10E	Area 5: Lifelong Learning and Nontraditional Students - Practical experiences
10F	VISIR Special Session : VISIR Special Session: Practical Workshop on VISIR electric and electronic remote labs
11A	Area 4: Learning Models - Methods
11B	Area 3: General Issues in Engineering Education - Theories and studies about learning layouts
11C	Area 2: Design Experiences - Tools and procedures
11D	Area 1: Computer and Web based Software - Security and Data Bases
11E	ANECA Special Session: New Directions in Engineering Accreditation, Quality and Course Design
11F	Area 2: Laboratory Experiences: on-site and remote environments - Didactics for experimentation

KEYNOTES SPEAKERS

Susan M. Lord – Professor and Coordinator of Electrical Engineering, University of San Diego, San Diego, CA, U.S.A. President of the IEEE Education Society



Susan M. Lord received a B. S. with distinction in Electrical Engineering and Materials Science and Engineering from Cornell University and the M.S. and Ph.D. in Electrical Engineering from Stanford University. Author of over seventy publications, her teaching and research interests include electronics, optoelectronic materials and devices, service-learning, feminist pedagogy, lifelong learning, and engineering student persistence. From 1993-1997, Dr. Lord taught at Bucknell University. She is currently Professor and Coordinator of Electrical Engineering at University of San Diego (USD). Her research has been supported by several National Science Foundation (NSF) grants from various programs including a CAREER grant, instrumentation and laboratory improvement (ILI) grants, scholarships for STEM (SSTEM), gender in science and engineering (GSE), and innovations in Engineering Education. She is the Guest Co-Editor of a special issue of the International Journal of Engineering Education on Applications of Engineering Education Research. Dr. Lord has worked at SPAWAR Systems Center, NASA Goddard Space Flight Center, AT&T, and General Motors. She is a member of the IEEE, ASEE, SWE, and Tau Beta Pi. She has served on the national administrative boards of the IEEE Education Society (EdSoc) and the ASEE Education and Research Methods (ERM) Division. Dr. Lord served as the General Co-Chair of the 2006 Frontiers in Education (FIE) Conference and has served on the FIE Steering Committee since 2006. Dr. Lord served as Vice President of EdSoc for 2007-2008 and President for 2009-2010.

IEEE Education Society: Global Leader in Engineering Education

The IEEE Education Society (EdSoc) is pleased to be a sponsor of EDUCON and technical co-sponsor of TAEE. EdSoc leaders view this conference as vital for carrying out the mission of our society and believe that EDUCON will be at the forefront of global Engineering Education in the future. In this talk, I will describe some of the history of the Education Society, its recent strategic planning process, and its hopes for the future. What is the Education Society? In April 2009, EdSoc leaders developed new vision and mission statements to introduce EdSoc to the world. The vision of EdSoc is “The IEEE Education Society strives to be the global leader in Engineering Education”. The mission is “The IEEE Education Society is an international organization that promotes, advances, and disseminates state-of-the-art scientific information and resources related to the Society’s field of interest and provides professional development opportunities for academic and industry professionals”. Currently, EdSoc has about 3000 members globally including 30% from IEEE’s Region 8 (Europe, the Middle East, and Africa) and 10% from Region 9 (Central and South America). Strengths of the Education Society include being globally engaged, recognized, and sought after to collaborate in educational innovation, generating quality publications and conferences, and dedicated leadership.

Patricia Manson – Head of Unit, Cultural Heritage and Technology Enhanced Learning in the Directorate General Information Society and Media of the European Commission.



Patricia Manson has worked at the European Commission since the early 90s on ICT applications areas in the Community's research programmes and for the past 4 years has been involved in defining the research agenda and subsequent workprogramme for technology enhanced learning research and for its implementation through the funded projects. Prior to joining the Commission she worked in the UK on a research-funded post providing technology and market watch, as well as information and advisory services to the cultural heritage community on the adoption of ICTs.

Learning in the 21st Century: Technology-Enhanced Learning and European Research

The presentation will explore the challenges facing learning in the 21st century and describe the role of European research in technology enhanced learning in this changing context. Experience has revealed the importance of giving equal weight to the technologies, to the learning and to the improvements in learning and this balance is at the core of technology-enhanced learning.

Javier Uceda – Professor of the Automatic Control, Electronic and Computer Engineering Department at Technical University of Madrid. Rector of Technical University of Madrid



Javier Uceda received the M.Sc. and Ph.D. degrees from the Universidad Politécnica de Madrid (UPM), Madrid, Spain, both in electrical engineering. Since 1986, he has been a Professor of electronics with UPM. He has published several books and more than two hundred and fifty papers in international journals and conferences and he holds several national and international patents. He has been a member of the Editorial Board of the European Power Electronics and Drives Journal. His research activity has been developed in the fields of Power Electronic and Digital Electronic Systems where he has participated in numerous national and international research projects. His main contributions are in the field of switched-mode power supplies and dc/dc power converters for telecom and aerospace applications. In the year 2000 he was appointed Vice-Rector for

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Dr. Uceda is currently Fellow of the IEEE and a Senior AdCom member of the IEEE Industrial Electronics Society. He is a member of the Editorial Board of the European Power Electronics and Drives Journal and belongs to the Executive Council of the European Power Electronics and Drives Association where he is Vice-President. He has been Associated Editor of IEEE Transactions on Industrial Electronics. He was the Technical Program Committee Chairman of the IEEE Power Electronics Specialists Conference in 1992 and the General Chairman of the European Conference on Power Electronics and Applications in 1995. Prof. Uceda is also member of the Scientific Advisory Board of the Center for Power Electronics Systems (CPES), sponsored by the National Science Foundation in USA. Has received several individual and collective awards among which stands out the IEEE Third Millennium Medal.

Innovation in Engineering Education

Engineering is changing as a consequence of scientific and technological evolution and society needs and demands. Engineers need to understand the structure and behaviour of matter from nanoscale to extremely complex systems. Convergence of scientific and technological disciplines requires also an interdisciplinary approach in education. In this presentation some of the challenges and possible orientations in Engineering Education will be discussed.

IEEE EDUCON 2010 AWARDS

EDUCON Meritorious Service Award

EDUCON Meritorious Service Award will honor outstanding contributions to the administrative and management efforts for the IEEE EDUCON conference.

- Prize: Plaque and Certificate.
- Funding: Funded by the EDUCON Steering Committee.
- Eligibility: Must be a member of the IEEE Education Society.
- Basis for Judging: Dedication, effort and contributions.
- Presentation: During the Opening Ceremony of the annual IEEE EDUCON Conference.

History:

IEEE EDUCON 2010 – Dr. Russell D. Meier

Best Paper Awards

Best Paper Awards are appointed in the following categories:

- Infrastructure and Technologies for Engineering Education
- Innovative Materials, Teaching and Learning Experiences in Engineering Education
- Knowledge and Competencies in Engineering
- Educational Methods and Learning Mechanisms in Engineering Education
- Attracting, Engaging and Retaining Human Talent to Engineering

and furthermore:

- Best Student Paper
- Most Innovative Paper regarding Engineering Education

- Prize: Certificate.
- Eligibility: Authors of accepted submissions of the IEEE EDUCON Conference.
- Basis for Judging: Review results and voting of the session chairs especially considering the quality, originality, and attractiveness of the presentation.
- Presentation: During the Closing Ceremony of the annual IEEE EDUCON Conference.

CONTRIBUTIONS TO IEEE EDUCON 2010

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Session: 01A Area 4: Learning Models - Competency and Teaching methodologies

Competency-Based Pedagogical Wrapping

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Consequences of the Declining Interest in Engineering Studies in Europe

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Adjunct Enterprise Professors in the European Higher Education Area

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Competence certification as a driver for professional development: A IT-related exploratory case-study

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Competency-Based Pedagogical Wrapping

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Abstract—In this paper, we propose a novel learning-framework that is context dependent. We adopt a broad definition of learning context, encompassing learning domains and learner competencies. Context-based learning requires dealing with three major research thrusts: pedagogical categorization, learner modeling, and context matching techniques. The system architecture relies on a context matching engine and a set of pedagogical learning patterns to re-purpose learning objects according to contextual situations. A prototype is implemented on top of a common learning service registry, which supplies learning schema that map a given learning context and a learner profile, as well as instances of instructional learning services.

Keywords—pedagogy; learning personalization; learning design; semantic Web; Web services; design patterns.

SUMMARY

Significant progress in reusability of learning resources have been made [1]. Learning however, is not just about contents but also about the process through which content is repurposed into personalized learning patterns [2], which map instructional contents into experiential learning activities. Yet, this external pedagogical know-how is not conveyed in a reusable manner to field experts and learning interface designers. Process-oriented learning (instead of content-based approaches) is facilitated in this paper through adaptive learning patterns.

Trends in providing personalized learning can be achieved by developing an open composition scheme of versatile learning-services provision within a multilevel enterprise integration framework. There is a lack of approaches today that enable open, enterprise-wide integration of learning, which empowers passive learning-structures such as Learning Objects (LO) to display a polymorphic behavior to fit learning patterns.

Authors from different instructional role and expertise horizons, like Content Experts, Instructional Designers, Pedagogues, etc, statically design instructional instances in each dimension of learning processes. In doing so, they retrieve an exiting instance of a given learning dimension and enumerate all possible instances across another dimension that fall onto their domain expertise.

Working out a learner's profile through some stereotypes can happen using the standard IMS Learner Information

Package (LIP). This would permit to identify appropriate capability-enabled learning services. LIP is a specification of standard means for recording information about learners. It is designed to access information about learners, as well as their progress records. In doing so, LIP facilitates the transfer of learner-related information across different learning services or applications. Our approach exploits the inter-relationships between LIP elements to define learning patterns for an individual learner, within cognitive preferences, acquired competencies and expected learning goals.

Just as some people are left-handed, we learn better following different styles. A renowned educationalist David A. Kolb, has made an inventory of possible Learning Styles. These learning modes are deemed to be responsive to contextual demands. According to Kolb, learners perceive and process information in a continuum from a concrete experience to testing implications as members of the following patterns: Accommodators, Assimilators, Convergents and Divergers.

We define a learning schema to wrap contents into pedagogical learning patterns, based on contextual information. Learning pattern models are behavioral approaches to learning. Learning schema is an overall structure that defines personalized learning processes. Learning schemas are reconfigurable to match the dynamic changes in learning patterns within a given learning experience.

Initially, learning schemas are designed. A learning session identifies a schema model based LIP annotated goals, competencies and preferences. Schema advocated learning tasks are scheduled. Throughout a learning session, competencies are built and goals are fulfilled resulting in a reconfiguration of learning at the learning schema or task levels. A closed-loop format of learning automates the instruction delivery process in an autonomous fashion. A prototype is proposed and learning retention performance is evaluated. The results show improved performance compared to traditional course management systems.

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Consequences of the Declining Interest in Computer Science Studies in Europe

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Abstract— Official European statistics of education indicate that the number of students entering tertiary education have significantly increased between 2000 and 2006 [1], and indicate a trend that will continue. However, this increase is not reflected in every field of study; computer science and engineering are among those that have decreased each year, evidence of a decline of interest in following this career on the part of students. As a response to this disturbing fact, this paper aims to identify some of the possible consequences that this trend could produce in Europe. It will highlight the impacts in economic, social, political and pedagogical fields and explain how these segments will be affected if the decline in computer science persists. Supported by previous investigations and official reports, this analysis provides some examples of the problems already produced by the declining interest in computer science in Europe and proposes solutions such as teaching methods and learning strategies to attract more students to this field and therefore limit the negative effects in a near future.

Keywords-component; Computer Science studies, learning methods, teaching methods; Computer Science statistics

SUMMARY

European statistics reflected a low rate in the number of high school students choosing computer science as a career. While the number of students entering university is rising, this field of study represents just 9.9% and decreases each year [1].

Because of this, European countries might be affected by a low number of experts in technology that represents an important stake for industry.

Certain studies are investigating related questions about the number of students enrolled in technology. Some of these studies highlight the fact of the low interest in computer science as part of their results.

The Computing Research Association (CRA), for example, remark that the number of undergraduate students majoring in computer science significantly increased [2]; and a larger investigation by Mahar, J. [3] was dedicated to find strategies to attract women to computer science and increase the number of IT graduates.

The imbalance between the high demand of technology and the decreasing number of experts to support it, leads us to identify some important questions:

- How can Europe justify the decreasing interest in computer science studies when the demand from the technological industries remains stable?
- What are the main reasons that produce this decline in the choice of computer science as a domain of study?
- Is it important for Europe to promote Engineering school?
- What are the consequences of a reduced number of computer science experts in industry and research in Europe?

The first contribution of this paper suggest that in order to maintain the development of computer science as a career and as the basis of technology in Europe it is necessary to attract and retain human talent in this field.

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Adjunct Enterprise Professors in the European Higher Education Area

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Abstract— The PAVes Program (Profesores Asociados Vinculados a Empresa – Adjunct Enterprise Professors) of the University of Valladolid allows enterprises to offer a set of optional subjects dealing with the technological knowledge necessary for their operation. These subjects are not only very attractive for the students, as they are given the chance to get an insight of the world that will host them as employees in the future, but also could be studied to extract lessons about the future European Higher Education Area (EHEA). This work presents the PAVes program, the lessons learned that could be applied to the plan adaptation to the EHEA, and how the PAVes subjects could be better integrated with ordinary subjects in the upcoming EHEA.

Keywords—ECTS; Adjunct Enterprise Professors; Practical Education; Learning Technology; EHEA.

SUMMARY

The PAVes Program (Profesores Asociados Vinculados a Empresas – Adjunct Enterprise Professors) is aimed at bridging the gap in the educational plane between the industry and the academia [1]. This program represents a unique collaboration initiative in the Spanish landscape, and has revealed itself as a very efficient tool for the students of technical degrees in the University of Valladolid.

The industry has a very wide spectrum of very specific skills which are necessary for each of the activities carried out in the different areas. Traditional academic programs are limited in time, and priorities have to be assigned so all the basics of the profession can be taught. The idea behind the PAVes program is to take advantage of some of this industrial knowledge and bring it to the University students, so they can have a first approach to the details of some of the real industrial activities and the necessary skills to perform them) that they will carry out during their professional lives, effectively bridging the transition from student to apprentice. The teacher of a PAVes subject is an industry professional acting as Adjunct Enterprise Professor, classes could be conducted within that enterprise premises, and although students do not perform any practical industrial work during these classes, they learn the skills, techniques and knowledge to do so.

A very good approach to foster a coherent integration of industrial knowledge within University education is to actually

create links among PAVes and ordinary subjects. As the EHEA promotes a bigger presence of practical activities, ordinary subjects are also increasing the amount of this kind of practical contents. The approach suggested in this work is to take advantage of this fact, and interpret PAVes as a kind of practical modules that can be optionally “plugged” with ordinary subjects in order to substitute or complement the ordinary practices.

As the PAVes program has had an eminently practical approach and has tried to avoid traditional unidirectional learning methods, it can be considered a great information source to extract experimental conclusions about the new orientation of the education system in the European Higher Education Area. This information could be used for instance to drive the design of educational programs on the different subjects for the future convergent European framework.

The philosophy behind PAVes subjects is quite in line with the new paradigm driving the EHEA. Specifically [2],

- The contents are mainly practical.
- Reduced student groups foster teacher-student interaction, while at the same time adapt better to the industrial premises which are often not adapted to big groups.
- Student-centric learning, meaning that the teacher acts like a guidance to allow the students “discover” the knowledge by themselves.
- Emphasis in group and collective work, sometimes even mimicking real team structure of the enterprise.
- Focus on industry-specific skills.

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Competence certification as a driver for professional development: A IT-related case-study

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SUMMARY

The findings of the study fairly corroborate the initial research hypothesis related with a predicted positive effect of a concrete participation in a certification program, in the way these programs are perceived as possible skills and career development anchors. Significant differences were found in the perceived usefulness of a certification, if an employee participates or not in a certification program. The exploratory scale (CCES) presents satisfactory psychometric qualities in the used sample, but further studies are necessary with larger samples to further test the scale in other organizational contexts. The relevance of this study is associated, we think, with the raising relevance of learner and individually-centered learning processes, the shift from just-in-case to just-in-time to just-for you education approaches, and the diversification of training strategies and learning loci that can co-exist in contemporary workspaces. Despite the growth in the use of these programs as institutional training alternatives, their success isn't linearly guaranteed, as they depend, in a considerable scale, of the applicants' commitment to learn, their ability to control and pace learning activities, and the existence of external support and encouragement, and, for this study's sample, the age and job role of the certification program applicants. These variables are particularly relevant if certification programs success largely depend of self-paced learning efforts, a potentially conflictive context where learning activities can be seen by applicants as a result of personal investment, and not as a result of a corporate learning policy.

In short, the results indicate that there is a significant difference in the perceived usefulness of a certification, if an employee participates or not in a dedicated certification program. This difference is more significant in more senior, management-related roles, as for junior engineers that don't participate in a certification program, this participation isn't seen as a professional development anchor or a valid education driver. The study further points out that certification programs tend to be judged in an instrumental way, more by its positive effects in terms of career management or professional within-peers recognition, than by its intrinsic value as institutional or personal development drivers. Investing in formal trainee-led learning efforts within the workspace imply a shift in the way training

periods are conventionally planned in work organizations; creating multiple learning loci in contemporary workplaces, using, for instance, competency certification programs as a option, is a current managerial challenge, as it poses new involvement demands to managers and training promoters, the need for constant renewal of training materials and resources, due to high-paced knowledge erosion, and the systematic monitoring of individual, asynchronous skill adjustment effort.

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Session: 01B Area 3: Specific Engineering Disciplines - Researches

Student Internship Placements. Improving the quality of engineering internship programs.

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Training Microsystems Technologies in an European eLearning Environment

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A Project-Oriented Integral Curriculum on Electronics for Telecommunication Engineers

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Educational Research in Spain: A review through the Education Awards of CESEI - IEEE

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Student Internship Placements

Improving the quality of engineering internship programmes

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Abstract— Work Internship Placements (WIP) is a transversal programme of enterprise internships for the engineering students of UdG which is focused on quality, academic control and satisfaction of enterprises. Its fundamental infrastructure is a web-based intranet platform that provides a complete set of WIP tools for every participating agent. WIP has proved to be a valuable asset both for students and enterprises.

Keywords: *engineering internship programme; quality placements; intranet web platform; internship coaching*

SUMMARY

Exposing engineering students to a real working environment provides the student with a complimentary and fundamental view about engineering, being this a key component in the Bologna process. Enterprise internships have always had a great importance in the bachelor engineering programs of the Polytechnic School (EPS) of the University of Girona (Spain). This preliminary professional training experience provides the students with an opportunity to apply what they have learnt in a real environment and to acquire useful and efficient new work habits. Moreover, internships become a fundamental key factor in the student academic motivation [1].

In 2005 EPS started a new transversal internship programme, called *Work Internship Placements (WIP)*, which has been designed specifically to overcome the drawbacks of previous models while taking profit of their positive aspects. Thus, WIP is focused on the improvement of internship quality, increase of the academic control and on promoting the interest and satisfaction of collaborating enterprises. In WIP, students are enrolled in a specific course in the engineering curriculum having a selected team of coaching professors devoted to follow the advances of the student during the internship.

One of the key elements in the success of WIP is that it provides a specifically designed intranet web platform to all internship participating agents (students, enterprises and professors). This platform centralizes the set of tools, procedures and tasks involved in all stages: information, meeting, contacts, registration, management, statistics and evaluation. This model is perfectly scalable, so that an

increase of the number of internships can be easily handled by the platform.

The programme works as follows: (1) participating enterprises and institutions propose online their *in situ* engineering placements, (2) placement proposals are revised and approved by WIP administration, (3) students access the web and apply for the placements according to their curriculum and interests. (4) The enterprise receives online the applications, the students are interviewed and, possibly with the help of coaching professors, the enterprise carries out its selection. (5) Whenever a student has been selected for a placement, a coaching professor from EPS and an engineering coach from the enterprise are assigned to the student. (6) The internship starts with a meeting between the coaching professor, the enterprise coach and the student. During this meeting a working plan is defined, pointing out the tasks that will be carried out by the student. (7) During the internship, those three partners are in contact at regular arranged times. (8) After the internship, the student is assessed by the coaching professor taking into account the enterprise opinion.

Currently, the WIP course is not yet mandatory, but according to the strategic guidelines of the Bologna process and as a result of its success, it will be mandatory in the near future for some of the engineering degrees of EPS. This mandatory nature is also supported by the dominant opinion of our regional industrial environment, which thinks that WIP makes a very significant contribution towards providing industry with engineering graduates who are well-prepared to assume engineering assignments, with less need for on-the-job training and with generic skills through problem-based learning. This agrees with other works that can be found in the literature [2,3].

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Training Microsystems Technologies in an European eLearning Environment

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Abstract—The paper presents the ongoing activities within an European project for development of eLearning courses in microsystem technologies.

Keywords—Microsystems technology education, performance-centred approach; e-learning, European project

SUMMARY

The shortage of engineers in micro-nan systems and the systematic decrease of students in electronics at the university can be a threat to the European economy competitiveness. In the 21st century the high level research is increasingly complex and interdisciplinary. There are very few individual research teams, laboratories or companies that can reasonably claim to be able to respond to the technological challenges. The Internet courses within the mSysTech project will provide new opportunities for co-operation between vocational training institutions, universities and SMEs in the sharing of knowledge and educational resources.

This project is aimed at adapting and integrating innovative performance-centred training approaches into engineering education and training organisations and SMEs in microsystems technologies. The focus is on the transfer of innovation in two new countries: Romania and Bulgaria and in the multidisciplinary area of microsystems. Its objectives are:

- identifying and analysing user requirements of managers, engineers, students and technical staff in the multidisciplinary science of microsystems technologies,
- selecting ICT-based innovative content to meet these requirements and analysing the feasibility of transfer of the performance-centred approach to train this content,
- adapting and implementing the e-learning environment with training materials with simulations, demonstrations to improve skills in microsystem technology.
- training the core user groups of training providers – teachers, managers and educational policy makers in the innovative learning approaches and in the effective collaborative use of new technologies in vocational education and training.

The primary target groups concerned are: students in engineering education and vocational schools, professionals from SME in electronics and microsystems, educated but unemployed people (e.g. engineers, physicists) looking for additional training for employment.

The mSysTech project is based on the positive results and experiences in two European pilot projects: Leonardo da Vinci project “Internet-based Performance Centred Instruction – the Link between Work and Education” (IPC I) and Socrates/Minerva “On-line Learning Mathematics and Sciences”.

Within the IPCI project a complete set of courses covering microelectronics design, technology and packaging were developed. There are not many frameworks that unify these subjects in an attractive way. The performance centred approach has been proven to be more effective than the traditional lecture-practice-test (expository inductive) in training higher order skills, for preparing learners for self-learning, improving, adapting for changing tasks, jobs.

In mSysTech the performance-centred job-linked training approach will be used also and the selected content from the courses of IPCI will be adapted and up-dated for the needs of Romanian and Bulgarian electronic sector and education. The new learning materials on the microsystem technology and the evolution of nanosystems during the last three years (after the end of IPCI) will be developed and used by all partners in the project, as well by the partners from the IPCI project who are not in the mSysTech partnership.

The project main result will be an e-learning environment with innovative pedagogical approach and the use of state-of-the-art multimedia materials to train the newest technological achievements in the sciences representing the basis of the e-Europe. It will provide performance support to the individuals undertaking self-directed learning.

The courses available on Internet will improve the accessibility of the learning materials and the delivery of training in all contexts: at home, in the university or vocational school, and the most important – on-the-job.

A Project-Oriented Integral Curriculum on Electronics for Telecommunication Engineers

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Abstract—This paper describes the Electronics curriculum in the Telecommunication Engineer degree at Rey Juan Carlos University (URJC) in Spain. Telecommunication Engineering started in the 2003-2004 academic year. In these years, all the electronic courses have been set up with a main practical orientation and with Project Based Learning (PBL) activities, both compulsory and voluntary. Once these courses have been successfully implemented we have reoriented some of the practical activities to be more interlaced. In this sense, projects involving students of different courses have been developed, as well as projects involving students from different years. All these activities fit in the principles promulgated by the Declaration of Bologna, which results in the actual updating of the university degree structure in Spain.

Keywords: *integral curriculum, Electronics, project-oriented, Bologna process*

SUMMARY

The regulatory modifications promulgated by the Bologna Process results in the implementation of new university degrees structures in Spain and the adoption of the European Credit Transfer and Accumulation System (ECTS) [1]. As a result of this process, new teaching methodologies have to be introduced focusing on a more active participation of students in their learning process.

In this context, the electronic courses have been set up with a main practical orientation and with project based learning (PBL) activities, both compulsory and voluntary. These courses have been successfully implemented [2]. We have also reoriented some of the practical activities to be more interlaced. Projects within more than one course and activities among students of different courses have been developed. Moreover, projects to be executed in more than one academic year have been carried out.

A. Electronics Curriculum in Telecommunication

Fig 1. shows the courses related to Electronics taught in the Telecommunication degree. All these courses are compulsory. All courses, except those shaded, are taught by the department of Electronics; therefore, we have been able to elaborate a complete and comprehensive Electronics curriculum without overlapping contents.

As can be seen, the courses cover both digital and analog electronics. Besides, students learn about computer

fundamentals. On their fifth year, students can also work on their MSc. Thesis in our department.

year-semester	1-1	1-2	2-1	2-2	3-1	4-1	4-2
Analogue Electronics	CAD (6 cr.) Circuit analysis & design	ECM (6cr.) Electronic Components & Measures	AE (6cr.) Analogue Electronics				EI (6 cr.) Electronic Instrumentation
Digital Electronics		DE1 (4.5cr) Digital Electronics I	DE2 (4.5cr) Digital Electronics II		SED (6cr) Digital Electronic Systems	ECSD (6 cr.) Electronic Circuits & Systems Design	
Computer Fundamentals			CF1 (6cr.) Computer Fundamentals I	CF2 (6cr.) Computer Fundamentals II			

Figure 1: Electronic and related courses in the degree

B. Project Based Learning Among different Courses

We are currently carrying out voluntary lab works involving knowledge of different courses. In these labs, students of different courses jointly develop an electronic design. These labs follow a PBL methodology. We have developed two kinds of lab projects: horizontal and vertical projects. The horizontal projects involve students of the same year. These projects can be considered as horizontal in the sense that all students have the same level.

The vertical projects involve students of different years. These projects are considered as vertical since students of upper courses guide the other students. As a consequence, the competences learned are wider than those learned in a same-year project. As an example, a complete electrocardiography (ECG) system is used to connect the different courses (fig. 2). In this lab, a complete project is developed, going from the biological signal acquisition to signal communication, processing and visualization on a monitor.

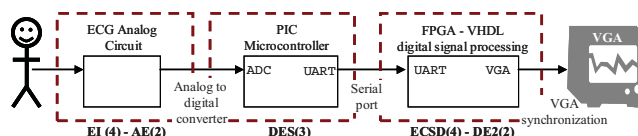


Figure 2: Vertical project: analog block in EI and AE; microcontroller block in DES, and the processing block and visualization block in ECSD and DE2.

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Engineering Education Research in Spain

A review through the Education Awards of CESEI - IEEE

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Abstract— In this paper, a review of the educational research that is being developed in Spain is realized in the areas of Electrical, Electronics, Telecommunications and Informatics through the works presented to the prizes CESEI (Spanish Chapter of the Education Society of the IEEE) in his three editions. An analysis of the working areas, the subjects covered as well as the conferences and journals where the results are published has been done. The main goal of this paper is to have a general vision about the work done in such areas of educational research in Spain that will be very interesting for academic staff and researchers.

Keywords- *doctoral thesis; educational research; engineering*

SUMMARY

In the last years, an effort for empowering the research and innovation in higher education is being observed. This effort has been reflected in the increase of the number of reviews and conferences dedicated to the higher education, as well as in the number of papers and research projects developed in this field.

In the present paper, a review has been done about the research in education carried out in Spain in the areas of Electrical, Electronics, Telecommunications and Informatics through the works presented to the CESEI prizes (Spanish Chapter of the Education Society of the IEEE) in its three editions 2007, 2008 and 2009.

IEEE includes many unique technical societies, active in the areas of publications, conferences and building technical communities. Between these organizations, we can find the Education Society (EdSoc) [1].

Its fields of interest are: "Educational Methods, Educational Technology, Instructional Materials, History of Science and Technology, and Educational and Professional Development Programs within Electrical Engineering, Computer Engineering, and allied disciplines" [1].

In Spain in the year 2004 was created the Spanish Chapter of the Education Society of the IEEE (from now on CESEI). The CESEI has the same interests and aims that the IEEE EdSoc has and to whom it belongs, but the CESEI tries to develop its interest and aims in Spain and in Spanish language [2].

Among the activities promoted by the CESEI in the year 2006 one of the most relevant was the prize for the best

Doctoral Thesis and for the best Final Degree (or Master) Project, being the thematic related totally or partially with the research or technological applications with the education in the frame of the disciplines covered by IEEE, areas of Electrical Engineering, Electronics, Telecommunication Engineering and Informatics.

The number of works received as candidates to the prizes (106) allows performing an analysis about the fields of interest in educational research that is being developed in Spain. This is the main objective of this paper.

In the Final Degree (or Master) Projects, in spite of the great variety of theses, there are three main areas of work: Tools and Strategies applied to the education, Special education and Virtual instrumentation-Remote laboratories. The second one represents the 12% of the total Final Degree (or Master) Projects, which reveal the importance that this field is gaining in Spain in the last years.

The 76% of the Doctoral Theses received deal with Computer Engineering and Telematics-Telecommunications (38% respectively for each one). No doctoral theses have been received from the area of Electronics Engineering and only 5% of Electrical Engineering.

The results of the Doctoral Theses have been published in a large number of technical reviews and conferences (53 about education) so in English language as in Spanish or Portuguese.

The data allows encouraging the academic staff to work in this research field because they have a lot of possibilities to show and discuss the results of their work at the same time they increase the results for both areas of work the education and the research.

The main objective of this paper has been to show a general vision about the work done in Spain in such areas of educational research that we think that could be very interesting for academic staff and researchers.

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Session: 01C Area 1: Collaborative and Social Technologies - Social Computing

OER's production cycle with social authorship and semantic tools

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Meta-analysis of the TAAE project applying social network analysis

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Social Media Enhanced Studying and Learning in Higher Education

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OER'S Production cycle with Social AuthorShip and Semantic Tools

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Abstract— Open Educational Resources (OER) are digital content that are accessible through web repositories. They are used as support tools for education, especially for higher education, and they promote equality and social justice by providing access to, applying, and generating knowledge. Until now OER's have been developed from the pedagogic perspective, without taking advantage of the recent developments in communication technologies.

Integration of social tools improves the active participation of both the developers and users of the OER's. This promotes the rapid creation of content that is easily accessible via search engines linked to educational platforms and social networks. It also allows *tagging*, which gives users the ability to add descriptive metadata. Authorship is recognized through the use of intellectual property licenses that promote open use of the material so that it can be used and edited. And above all collaborative learning is promoted.

In this article a new cycle of OER production is proposed that includes activities to incorporate social networks and semantic technologies. The phases of the production cycle are developed using the ADDIE instructional model. The purpose of each phase and the social and semantic components to be included are identified. And finally, application guidelines are presented that detail the strategies and expected results for each phase of the proposed cycle.

We have determined that the primary reasons for developing a production cycle for OER's using social authorship are: to allow educators and students to develop resources collaboratively; to reduce the amount of time spent in resource development; and to provide for reutilization of quality OER's. Finally, it should be recognized that the success of the model and its application depends on the institutional context where it is implemented, as well as the policies related to content generation, authorship acknowledgement and distribution of the resources.

Keywords-component; Open Educational Resource; Social Authorship; Semantic Web; Collaborative Learning.

This research project has been partially supported by the Republic of Ecuador through the SENACYT. This project was developed thanks to financing from Project AL_PID09_036 of the UPM.

SUMMARY

Open Educational Resources (OER) have been identified by the Flora Hewlett Foundation, one of their primary supporters, as a means of providing equal access to knowledge worldwide [1]. For this reason, many universities throughout the world are involved in these types of initiatives. These initiatives have also raised the interest of international organizations who are working to develop a framework that will assure accessibility, usability and quality of the content and structure and tools utilized to produce OER's.

The Web 2.0 allows users to actively participate in the development of knowledge through the use of tools such as blogs, wikis, RSS, social networks, microblogging, etc. The Semantic Web is the web of data, that is, it incorporates meaning through the use of semantic metadata and ontologies and allows users to find results more quickly and easily.

OER development would be enriched by the features offered by the Web 2.0 and the Semantic Web. These features can be integrated in to the production cycle to promote collaborative learning between producers and consumers of resources during both development and implementation. Also, the use of tagging and other semantic technologies optimizes the detection, identification and dissemination of OER's. This proposal also supports the use of Creative Commons licenses for authorship recognition, which should be adapted to the individual policies of each institution.

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Meta-analysis of the TAEF project applying social network analysis

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Abstract— The paper shows the application of some techniques, metrics and indicators of social network analysis in order to respond to a group of questions asked by the organizers of the conferences the project of Technologies Applied to the Teaching of Electronics (TAEF).

Keywords— component SNA, meta-analysis, TAEF, metrics, results, RedOBER

SUMMARY

The aim of this paper is to conduct a meta-analysis to data generated by the congresses of the TAEF project (1996 to 2008), through the techniques of social network analysis, setting as a data source the 8 conferences organized, 964 documents, 1348 unique keywords, the 1092 participating agencies, the 1674 authors, the 11 thematic families, the 150 sessions, among other data.

The tool used for meta-analysis was Pajek, an open source tool with the capacity to handle large volumes of data.

To meet the proposed target is considered the following questions: What are the relationships and the level of cohesion of the different organizations (at the level of Spain and across continents) involved in TAEF? How have evolved the thematic covered in the conference? What are the new additions ontological in technology over the years? How have evolved the thematic in the research and studies related to teaching electronics? Was also carried out another analysis with the aim to investigate: the relationship between the documents developed at the congresses and the keywords that were used to describe them, as well as the structures that form between co-authors of documents.

To answer these questions we used the following metrics of social network analysis: degree of a vertex and density (to study connections and distances between actors), the degree of centrality, closeness and betweenness (to determine the power and centrality of an organization), furthermore weight

networks, Hubs, Authorities (to study the relations between thematic and keywords), k-cores (for relations between coauthors).

The results obtained by applying social network analysis in the documents of the Congress of the TAEF project are complementary to the statistical analysis and have enabled: see graphically the relations among the various participants, and the thematic families development, facilitating the task of finding isolated organisms and organisms that serve as a link or bridge with others, has identified the relationship between keywords and different families themes and structures that exist between co-authors.

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Social Media Enhanced Studying and Learning in Higher Education

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Abstract—Social media services have recently become well known especially among young people [1]. In social networking sites a user can participate intensively in activities in the service. To support collaborative study at Tampere University of Technology (TUT) and also to provide social networking tools for students especially at the beginning their studies, the development TUT's own social network site was begun in spring 2008. To make the system popular among students, developers and researchers at the Department of Mathematics and Hypermedia Laboratory at TUT designed interventions for fall 2009 when the semester began and new students started their studies. The earlier research [2] revealed numerous motivating aspects that should be somehow included in a study oriented social networking site. This paper will describe the research results of interventions to motivate students to use a social networking site in the context of studies. The results will show that such an environment with social aspects connected to studying and study life on various levels is a means of enhancing studies and basically a necessary tool, especially for students in the early phase of their studies in a new university. The motivation should be further encouraged by the system itself when it relies on students' own voluntary activity. Moreover, the intensive actions of developers, researchers and administrators can be used as tools in directing network activity development.

Keywords; social media, social networking, study support, motivations, interventions, mathematics

SUMMARY

In social networking sites a user can participate intensively in activities in the service, share contents, debate and share opinions and create different kinds of groups for different needs. One of the crucial problems in (Finnish) university level studies is that the very early steps at the beginning of studies are the most difficult for many students. One reason for this is that only a few new students know any of their peers at the beginning of studies in their new university.

The social networking site *TUT Circle* is a web based environment for students offering customized tools for enhancing social aspects of student life at TUT. The primary target is to provide an efficient and compact system to help new students at TUT to create new social contacts with each other and with students already studying at TUT, e.g., peer tutors etc. The secondary target is to help students form

studying groups and circles for their own needs considering their motivations, attitudes, learning methods and orientations. Supporting studies is one part of the whole.

To make TUT Circle popular among students, developers and researchers at the Department of Mathematics and Hypermedia Laboratory at TUT designed interventions for fall 2009 when the semester began and new students started their studies. During summer 2009 the focus was on encouraging the activity of new students so that in fall the study supportive widgets would have been easily-obtained and used by students.

In autumn 2009 data was also collected from 38 hypermedia students regarded as early adopters. They were asked to sign up for TUT Circle and analyze aspects, functions, or features motivating users to use the service.

In the evaluations the same topics from the earlier research [2] were emphasized. After all, TUT Circle was seen to increase a sense of belonging, because in the system it is "easy to discuss local issues and get to know the people at TUT".

For basic usage monitoring in TUT Circle *Google Analytics*TM is used. Using this data the network activity can be analyzed from the perspective of interventions executed. In TUT Circle there is also a tool that is used to collect log data in XML (*Extensible Markup Language*) format about different network actions. The data can be used for SNA (*Social Network Analysis*) that enables enriched network information production. The results of this analysis support the results of motivation research. It is obvious that a social networking site in the context of studying requires constant steering when system usage is not mandatory at any level.

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Session: 01D Area 1: Computer and Web based Software - Web based services

Web-based Time Schedule System for Multiple LMSs on the SSO/Portal Environment

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A system to manage the allocation of MSc Dissertations at University of Minho

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Supporting the Delivery of Learning Contents with Laboratory Activities in SAKAI

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Web-based Time Schedule System for Multiple LMSs on the SSO/Portal Environment

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Abstract— We developed a web-based time schedule system as an important feature of the university portal along with our university's long-term ICT (Information and Communication Technologies) plan. By using the system, students and professors can get their own course timetable in collaboration with the Student Information System (SIS). Each course name on the timetable is linked to the corresponding course page on the Learning Management System (LMS) through the Single Sign-On (SSO). The system is adapted to multiple LMSs which can be selected by the course professor. In order to widely cooperate with other systems, the system is designed by using global standards and open source software as possible as we can. This paper shows the major functions, the measured use of the systems over eight months, and the implementation especially for supporting multiple LMSs, syllabus and grade books.

Keywords- timetable; schedule; LMS; Portal; SSO; IMS; CAS

INTRODUCTION

In recent years, the university's learning environment is becoming more and more convenient, effective and efficient by various ICT(Information and Communication Technologies)-enhanced systems. Our university has established a long-term and university-wide ICT strategy plan in 2001 [1]. Good collaborations among the systems should be very important to build ICT-enhanced learning environments, and therefore, we always try to use global standards and open source software as possible as we can for data interoperability and source transparency.

Along with the ICT plan, we developed a Single Sign-On (SSO) university portal. Once authentication is complete, user gets personalized web pages, including information for each role, direct links to the available systems, etc. As an important feature of the portal, we developed a web-based time schedule system placed on the portal.

THE TIME SCHEDULE SYSTEM

We developed the portal for all students and staff based on open source software (uPortal [2], CAS (Central Authentication Service) [3], etc.) and the original tools for

connecting several university-wide systems [4,5]. Once authentication is complete, each user gets personalized web pages, including information for each role, direct links to available systems, etc.

The time schedule system was added to the portal, and where students get their own course timetable depending on their registration at the School Information System (SIS). Each course name is directly linked to the corresponding course page on the Learning Management System (LMS) through the SSO. Professors also can use their own timetable linked to the LMS course in the mode of instructor and creator. The system supported multiple LMSs (WebCT CE6, Moodle 1.9 and partly Sakai 2.6), the syllabus and the grade-book synchronized with SIS by using the IMS Enterprise standard [6].

THE STATUS OF THE SYSTEM

We measured the use of the portal and the time schedule system over eight months. The portal has more than 7,000 daily accesses at the beginning of the semesters, after that, it has a few thousands of accesses on weekdays and several hundreds still remain even on holidays. Because our university has about 10,000 students and 2,000 staff, we can say that the portal is used very well. The access of the time schedule system occupies about 10 to 30 percents of the total accesses of the portal. We therefore conclude that the time schedule system is also used well.

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A system to manage the allocation of MSc Dissertations at University of Minho

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Abstract—This paper describes the basis for the specification of an IT infrastructure, supported by a website, designed to manage the entire paperwork process associated with the management of Masters Dissertations. With this infrastructure it is possible to disclose the subjects offered, to allocate each subject to a candidate - "dissertations in progress", browse dissertations that are awaiting review and consult the archive of dissertations with exams already carried out. PostgreSQL technology was used to support the databases. This technology was chosen to be robust, with easy integration with PHP and its code is open source. The website is housed in a Linux server based infrastructure ready to run continuously.

Keywords – CMS – Content Management System, Website, Backoffice, Frontoffice, PHP, Bologna Process, Dissertation

I. INTRODUCTION

The higher education systems have undergone great challenges in the last decades, initially motivated by the growing up number of students. Currently, the importance of communication technologies is found in the strong dissemination of knowledge, which has been taking place in the European systems, through the Bologna Process. The Bologna Process is named after the Bologna Declaration, which was signed in the Italian city of Bologna on June 19th of 1999 by ministers in charge of higher education from 29 European countries [1].

The Bologna Declaration leads to the adoption of a system essentially based on two main cycles, undergraduate and graduate. The access to the second cycle hall requires successful completion of first cycle studies, lasting a minimum of three years. The second cycle should lead to the writing of a master thesis.

The dissertation topics are proposed by the advisors. The students then choose one topic from the whole list of topics available. When a dissertation topic is assigned to a given student, by his supervisor, the work process starts and lasts until the dissertation report is finished. After the supervisor approval, the dissertation is submitted to an examination which will be evaluated by a jury that will award a final mark. Finally, after the exam, the dissertation document is put in an electronic archive.

In order to manage this process an information system based on a website has been created, using the PHP programming language [2]. The website is divided into two main components: the Frontoffice and the BackOffice.

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Supporting the Delivery of Learning-Contents with Laboratory Activities in Sakai

Work-in-Progress report

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Abstract— Educational and training-providing institutions are increasingly depending on the web-based *Learning Management System (LMS)* for delivering course-contents in both on-campus and distance classes. This system offers an easily-accessible environment with various tools for managing learners and courses, and for producing rich contents. However, beside the rich contents, certain fields of study require that courses be accompanied with/followed by laboratory activities which help learners deepen their understanding of the new concepts and develop skills on applying them in close-to-real-world context. More emphasize has been put on these activities when laboratory-based courses appeared and proved to be functioning well in delivering the information. Several stand-alone laboratories have been constructed to support delivery of such activities on-line, but laboratory-tools are not available within the LMS. To address this point, our research presents an approach towards integrating one stand-alone laboratory (NVLab) into Sakai LMS to enable the use of laboratory activities within the course context. The study suggests integrating parts of the original system into Sakai, and then using the LMS's "linktool" to connect to the other part. So far, an initial version of the new tool has been accomplished and we are in the testing phase of the new tool on a demo version of Sakai before putting it into service within the campus-wide system.

Keywords- K3.2 Computer and Information Science Education; K3.1.d Distance Learning; Web-based Laboratories; Learning Management Systems

INTRODUCTION

Web-based LMS is easily-accessible and incorporates tools for managing courses, learners, grades...etc, and other tools for supporting the learning process. The later are designed to assist in producing rich course-contents and to facilitate the interaction among learners and between them and their instructors.

However, some curriculums require more than what the LMS offers especially where the contents should be supported with laboratory activities that help learners deepen their understanding of the new concepts and get to know how to apply them in close-to-real context as in the case of *Information and Communication Technologies* online course. Tools that enable delivering such activities are not available within the LMS; therefore, stand-alone web-based laboratories appeared to support this function [1].

But in contexts where carefully-designed dynamic-contents/practical-activities were combined with the course static-contents it was proven that learning-performance was better. This, in addition to the success of laboratory-based courses, indicates the importance of building a tool for either integrating practice-acquiring facilities into the online-course, or linking the stand-alone laboratory with the LMS.

• Paper contribution

Addressing the previous points, we demonstrate our technical approach towards integrating a stand-alone web-based laboratory (NVLab [2]) that we already built for supporting courses concerning *Computer Networks* into Sakai LMS. Sakai has been selected for some specific reasons: 1) it is an open and freely available LMS that is kept by a community on the Internet; 2) it is evolving all the time and the number of organizations implementing it is increasing; 3) Sakai is written in Java language which is the same used in NVLab and this would make our progress faster.

RESULTS

We succeeded in creating a new laboratory-system that can be incorporated into the courses delivered in Sakai LMS. This system includes a new tool that learners use for producing a network diagram, saving it in the course resources, and realizing it on a server that can be allocated to the individual learner. And beside this new part, the learner will be able to use Sakai's *linktool* for connecting to the server on which his/her network was created to start working on the network devices. The system has been tested by introducing a simple exercise on basic IP addressing and connectivity check, and the learner was able to complete the exercise successfully

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**Session: 01E Area 1: Computer Supported Collaborative Learning - For use
in projects**

SUBA – An innovative pedagogical experience

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**Encouraging Interaction and Status Awareness in Undergraduate Software
Engineering Projects**

Charlton, Terence James;Devlin, Marie;Drummond, Sarah;Marshall, Lindsay
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The use of agents to represent learners in role-play training

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Game-based learning in technology management education

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SUBA – An innovative pedagogical experience

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Abstract— In this paper we will introduce the integrated projects implemented on several courses of the Electronics Engineering Bachelor and Master programs at IST with special emphasis on stimulate students' creativity and practice of implanting prototypes. The key hardware of these projects is a car model with controlled electric engine and sensors and actuators - SUBA.

Keywords – *learning experimentally; car models; component; ubiquitous learning.*

SUMMARY

In 2003/2004 academic year started at IST (Instituto Superior Técnico), Technical University of Lisbon (UTL) a new studies program: a 5 years engineering graduation program on Electronics Engineering. In 2006/2007 its curricula was adapted to Bologna system: a first cycle with 3 years leading to a Bachelor degree; followed by a second cycle with 2 years leading to a Master degree. Accordingly, the first Master on Electronics Engineering had concluded their studies in summer 2008.

The program curricula [1] is 90% similar to curriculum followed by a student on Integrated Master (5 years program) on Electrical Engineering and Computers, also from IST, if he choose Electronics as the main area of specialization and Telecommunications or Computers as secondary area of specialization [2]. However, these programs are radically different on the pedagogical approach. It was introduced a strong experimental integrated component from the first through the last semester.

The Bachelor and Master Programs in Electronics Engineering are aimed to providing students with advanced training in a vast range of knowledge and stimulate their creative skills, focused on cutting-edge technologies in electronic components, equipment and systems on all its aspects and applications (telecommunications, control, informatics, energy, etc.). These professionals should be able to meet different needs ranging from engineering design to production and commercialization of electronic products with a view to speed up the technological development of the country. Since in the first years of the Bachelor program most of the courses are on mathematics and physics and few on electrical engineering are introductory, to motivate the students and illustrate basic concepts several integrated experiments on an innovative pedagogical experience were

developed such as the SUBA project [3] that will be presented on this paper.

The novelty of this project is the integrated experimental part of several courses and its key hardware. The name SUBA comes from the basic hardware used on these experiments: a Rally car model **Subaru** Impreza WRX scale 1:10. The initials also stated in Portuguese “Be a good student” (*Seja Um Bom Aluno*). The car and its test scenarios include several sensors and control features. SUBA gives to students, from the beginning of their studies, the opportunity to learn several basic courses doing design of systems with progressive and complementary complexity, in an integrated way, benefiting from knowledge acquired in successive courses: Physics, Chemical, Logical Systems, Control, Computer Architecture, etc.

Due to the SUBA experience on the first years the students are more motivated to study in detail other courses like those related to control and electronic systems to fully understand the SUBA performance on experiments of previous courses. Also the students are willing to have projects and develop prototypes on advanced Master (2nd cycle) courses.

The SUBA platform is dynamic and new features are being added. New sensors are being developed on Master courses projects. On the mainframe of one Master Thesis a SUBA car with a hydrogen cell (SUBAH) was implemented.

Also the SUBA project is used to support the Electronics Engineering program objectives presentation in secondary schools where potential future students are now studying, not only with on site demonstration but also thru the SUBA website. Two simple versions of the SUBA are being developed by students' initiative, not included in any course, to be used on the secondary schools and exhibitions, showing their own interest on the SUBA project.

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Encouraging Interaction and Status Awareness in Undergraduate Software Engineering Projects

The Role of Social Networking Services

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Abstract—As part of the CETL ALiC initiative (Centre of Excellence in Teaching and Learning: Active Learning in Computing), undergraduate computing science students at Newcastle and Durham universities participate in a year long, inter-institutional group programming assignment. Teams of students act as “virtual companies” and collaborate cross-site to develop software products for real-world industrial clients. This paper investigates the emergence and autonomous adoption of social networking technologies in our students’ communication strategies during the project, and explores the role that “status awareness” (knowledge of the current activities of one’s team mates) had on the outcome of that collaboration. We also present and discuss the findings of a recent trial of *CommonGround*, an application created to harness our students’ pre-existing engagement with social networking technologies such as Facebook.

Keywords: computer science education; social factors; facebook; collaborative work; professional communication; programming; technology

SUMMARY

Active Learning in Computing is the first Centre for Excellence in Teaching and Learning (CETL) for Computing Science in England. The five year initiative is funded by the Higher Education Funding Council for England (HEFCE) and is a collaborative effort between a consortium of North East UK universities: Durham University, Newcastle University, Leeds Metropolitan University, and the University of Leeds. Running since 2005, the CETL aims to better prepare students for the realities of working in their chosen professions by aligning their learning experiences with those sought by today’s software engineering industries. In particular, it addresses the distributed working practices of many professional software development companies and, in turn, our need as educators to equip students with the skills required to work in this competitive environment.

As part of this project, we have extended the traditional undergraduate Software Engineering curriculum taught at both Newcastle and Durham universities to include a year long, inter-institutional team programming exercise, in emulation of modern industrial practice. Teams of students act as “virtual companies” and collaborate cross-site to develop software

products for real-world corporate clients (projects differ from year to year; examples include a supply chain logistics program and a mobile GPS graphing application). From a pedagogical perspective, this approach places a far greater emphasis on group collaboration and professional skill development than is usually adopted by university computing departments, despite research that indicates a number of significant educational benefits [1]. It also encourages greater engagement with the discipline, increases technical and transferable skill sets, and ultimately provides students with a genuine insight into the challenges faced by companies competing in a global market.

To support and encourage interaction between team members, we provide students with a variety of communication tools. These include fully equipped video-conferencing suites, virtual learning environments, forums and wikis. However, despite our best efforts, students continue to report substantial problems using these tools to communicate with their teammates both locally and cross-site. We have found that students find it particularly difficult to determine, even after face-to-face discussions, what their teammates are working on at any one time, and this in turn leads to duplication of work and increased frustration. Significantly, although the technologies provided by us do play a role in supporting the collaborative efforts of our students, they are frequently abandoned at an early stage in favour of the communication affordances of social networking sites such as Facebook.

Thus, this paper describes how students adopted and integrated “social” technologies into both their local and cross-site team communication strategies, and investigates the effect that “status awareness” – knowledge of the current activities of one’s team mates – had on the success of that collaboration. Furthermore, we report on the development and trial use of *CommonGround*, a Facebook application created by us to harness and monitor the high levels of student engagement with the platform.

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The use of agents to represent learners in role-play training

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Abstract—This paper proposes the use of agents to involve learners in role-play training for the study of project management. We have found that students have not been able to share the required information adequately with other students in role-play training. In order to investigate the effectiveness of using an agent in role-play training, we have developed a role-play scenario so as to practice with agents. The results of analyzing the behavioral track record of each learner in a role-play exercise with agents and a questionnaire survey taken among students indicate that the use of role-plays will enable them to learn human-related skills such as communication, leadership, and team building.

Keywords—component; Project management education; Agent; Role-play training

SUMMARY

Role-play training could form an appropriate tool for universities as an efficient alternative to on-the-job training (OJT) for project management education [1].

Since 2007 we have been developing an online group work training system named PROMASTER (Project Management Skills Training Environment) to increase the learning opportunities when studying project management using role-play training and to achieve profile-based education (PBE), which takes account of the progress in study of each individual student [2]. However, some students have not been able to share the required information adequately with other students and to fully appreciate the project management scenario that they have been role-playing.

In order to cope with this problem, a software agent system, which implements the advanced professional skills of project management, may be able to act as a mentor in a role-play.

In order to realize a sophisticated agent, a Non-Player Character (NPC)-based system which can estimate the appropriate behavior of an NPC assigned to a stakeholder role to maximize its profit [3].

A role-play training scenario using an agent has been developed. The scenario concerns building a team before a system development project starting. Two learners play the roles of the team leader of a system integration company and the project manager of a customer company, respectively. The task the two learners should practice is to select the appropriate

members of the project in a situation where there is a conflict of interest between two stakeholders.

According to the results of analyzing the behavioral track record of each learner in a role-play exercise involving an agent, and the results of a questionnaire survey taken among students who participated in a role-play exercise, the agent could be useful in helping learners to share information, to understand their roles as stakeholders, and to visualize the job of project management. It would be very helpful to develop an agent system which can solve the problem of how to improve human-related skills such as communication, leadership, and team building.

We will define an observable evaluation metric which can be used to evaluate the effectiveness of learning human-related skills by using the concept of NPC. We will also seek to implement human characteristics in an agent.

We plan to pursue our research based on the principle of using an NPC as follows: an agent will evaluate alternatives for decision-making by learners; in the next stage, an agent will act as a mentor in proposing alternatives to learners making a decision; and finally an agent expressing human emotion will be provided in order to simulate practical team work in a system development project.

Scripting all of alternative scenarios which may be derived by a learner while a role-play exercise is running is typically labor-intensive. A method for automatically generating all alternative scenarios should be established. In order to generate the behavior scripts case based reasoning (CBR) may be applicable to create scenarios.

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Game-based learning in technology management education

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Abstract— Management games allow students to obtain valuable first-hand experience that is of particular value in a field such as technology management, which usually involves substantial risk as well as significant time lags between a managerial decision and its effects. In drawing from more than fifteen years of experience with management games in higher education, we have developed a management simulation for teaching technology management, a field that is increasingly regarded an important area of study for engineering students. This paper outlines a blended-learning design for a course on technology management, describes the various didactical elements as well as their effects in class, and addresses the technical implementation of the management game as a service-oriented multi-tier application in Java.

Keywords— experiential learning; management game; simulation; technology management

SUMMARY

Technological innovations are essential for the success and survival of firms in today's dynamic market place. It is therefore not surprising that enterprises devote large amounts of resources to research and the development of new products. At the same time, uncertainty regarding the success of innovative endeavors is typically high. Given its strategic importance, the resources at stake, and the substantial risks involved, management of technology and innovation is not only considered a critical area of study in most business schools, but has also become highly relevant in engineering education.

As means for experiential learning, business gaming simulations allow participants to assume the role of decision-

makers that compete against each other in a “safe” artificial environment. By shortening real-world decision cycles from years or decades to hours or minutes in the simulation, the learning process can be accelerated dramatically, which should help participants to gain a better understanding of the real-life situation the simulation game refers to. The main objective of using business games as tools to enhance learning is to give participants the opportunity to apply theoretical knowledge in close-to-reality situations in order to develop decision-making competence, rather than solely acquiring theoretical knowledge.

In our paper we introduce a business gaming simulation that is designed for Master-level students with a particular interest in the management of technology and innovation. In developing this simulation we could draw from more than fifteen years of experience with business games in higher education and, thus, have had the opportunity to “cherry-pick” the most effective didactical means in order to tweak the learning outcomes.

We will outline the overall didactic design, discuss the conceptualization of the game as well as the thematic aspects covered in the simulation and describe the various didactical elements and our experiences in applying them in class. Furthermore, the paper will discuss the technical implementation of the business game simulation as a service-oriented multi-tier application in Java that supports multiple usage modes in order to allow for various educational settings. A summary as well as an outlook on further research will conclude our contribution.

Session: 01F Area 1: Intelligent Learning Systems

Continuous Proactivity in Learning Management Systems

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VenDASys – a versatile experimentation platform

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Virtual flute: electronic device that uses virtual reality to teach how to play a flute

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An adaptive Multi-Agent based Architecture for Engineering Education

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Miguel;Sarango-Lapo, Celia Paola;Valdiviezo-Díaz, Priscila Marisela
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Continuous Proactivity in Learning Management Systems

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Abstract— Three studies, conducted on graduate level, show findings that students with highly proactive behavior are more likely to succeed in a Learning Management System (LMS) environment. Statistical analysis techniques were used in the studies. In the second study the concept of continuous proactivity was introduced to observe if a study-group was more likely to succeed in the lesson compared to a control-group, and in the third study, proactivity was applied to the entire class. This paper reports the results of the second and third studies and introduces the concept of “continuous proactive learning strategies” to frame the future development of proactive rules in LMS.

Keywords: *Proactive Learning, Learning Management System, Learning Techniques, Learning Methods*

SUMMARY

Although there are already a large number of functions, covering a large number of users' needs for a variety of different users acting specific roles in these LMS environments, current LMS are fundamentally limited tools. They are only reactive software, content management based, and developed like classical user-action oriented software. These tools wait for an instruction, most commonly given through a graphical user interface, and then react to the user's request, limiting the value of the LMS to the user's own action and not to the needs of the learning process.

Learning is a continuous, step-by-step effort that requires conscious undertakes in order to achieve predefined learning goals. This continuous effort is orchestrated by pedagogic approaches where step-by-step strategies for instruction are defined. Different pedagogical theories exist: constructivism, resource based learning, collaborative learning, problem based learning, narrative based teaching, situated learning, etc. One of the common denominators of these pedagogical theories is the need of a continuous effort.

Proactive systems, as defined by Tennenhouse [1] adhere to two premises: working on behalf of, or pro, the user, and acting on their own initiative, without the user's explicit command. Proactive behaviors are intended to cause changes, rather than just react to changes. Proactivity is a means of continuous effort and student's continuous LMS interaction (engagement) is an approach to proactivity. Proactive Learning Management

Systems (PLMS) is a new kind of LMS, designed to improve the users' online interactions by providing programmable, automatic and continuous analyses of users (inter-) actions, augmented with appropriate actions initiated by the LMS itself.

This paper reports statistical analysis observations on three studies in Proactive Learning Management Systems (LMS). The first study [2] develops a simple proactivity test-case study to answer the research question: “Are students with high proactive behavior more likely to succeed in a LMS environment?”. This study was developed in a blended learning environment for a second year bachelor class during the winter semester of 2006-2007 and showed 82% correlation between online activities participation and exam results.

The second study, developed during the winter semester of 2007-2008, was designed in order to observe: “Are students with continuous LMS proactivity more likely to succeed in a lesson?”. This study utilizes a study-group and a control-group to statistically evaluate if the study-group is more likely to succeed in the lesson. Proactivity was continuously triggered to provoke students' participation and interaction via LMS and the study showed that the study-group performs 20% better than the control-group.

The third study, conducted during the winter semester of 2008-2009, generalized the application of the continuous proactivity to an entire class in order to observe: “Does continuous proactive rule have a direct positive impact in student's results?”, thus continuous proactivity will increase the probability of student's success in a lesson. This last study showed that active online participation in class forums is linked (68%) with the student's grade results. Furthermore, this paper introduces the concept of “continuous proactive learning strategies” to frame the future development of proactive rule in LMS.

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VenDASys – a versatile experimentation platform for educational purposes

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Abstract—In this paper we present an approach to increase the interest of pupils and high school students in modern science and technology. To achieve this, we developed a versatile experimentation platform for the use in schools and school projects, called VenDASys (*Versatile Control and Data Acquisition System*). VenDASys allows the interfacing of individual (micro-)sensors or complete experimental set-ups while minimizing the required electronics. Thus, students (and also teachers) can directly concentrate on and successfully deal with different sensors and experiments based on these sensors. Getting involved in comprehensible MEMS (*Micro Electro Mechanical Systems*) – applications and solvable problems at a relatively early stage of their education will definitely increase the chances that high school students decide to choose a technical education later on.

Keywords– open experimentation platform; micro-sensors

I. SUMMARY

In the last years the gap between the need and the availability of qualified personnel has been increasing in many technical and scientific fields. One direct consequence is the current drastic shortage of engineers. This problematic situation has been addressed in many activities around didactics and education, partly in different ways, e.g. [1, 2]. The MEMS-industry already regards this issue as a major challenge for future economic success. For this reason, in 2002, the German Federal Ministry for Research and Education (BMBF) initiated the foundation of six networks focusing on MEMS education and training [3]. One of the major goals of these networks, and especially for the network “pro-mst” [4], was to counteract this trend by increasing the interest of pupils and students in natural sciences and engineering.

Our learning lab SinnTec (*Sinn für Technik – technische Sinnesorgane*) was founded as result of our experiences within the network “pro-mst”. SinnTec addresses both high school students and teachers to gain hands-on experience. One of the major topics of this lab is to show where MEMS technology is used today, e.g. in a car. Secondly, students should actively work with micro-sensors as technical senses to gain a deeper understanding. From these activities [5] we learned that difficulties in working with micro-sensors do not primarily arise from the basic understanding of sensor operating principles or MEMS production processes but from the electronics required for sensor read out and finally for its useful application.

Based on this experience, we developed a universal and modular experimentation platform for use in schools and school projects with an open source concept allowing exchange of experiments between schools, teachers and students. The

VenDASys platform offers a very comfortable and straightforward opportunity to deal with micro-sensors by simply “bypassing” most of the electronics from a didactical point of view. Thus students and teachers in a simple way gain access to the field of MEMS in particular and science and technology in general by realizing their own ideas for experiments.

A. Short overview of the VenDASys platform

The VenDASys consists of a hardware platform providing basic functionalities and dedicated sensor interfaces, which is connected to a PC with a multi-purpose software tool realized in LabVIEW (*National Instruments, NI*) and dedicated sensor modules for different applications (Fig. 1.). The platform is connected to the PC via an USB (*Universal Serial Bus*) interface; sensor modules are connected to the platform via standard lab-cables (especially during the development phase) or via dedicated Sub-D25-connections with power supply and data exchange. The GUI (*Graphical User Interface*) realized in LabVIEW gives, the user full access to a variety of hardware functions (mainly analog and digital in- and outputs) without having to go into detail concerning the hardware set-up. In the contribution, a practical example for using the VenDASys platform (blood pressure measurement) is discussed in detail.

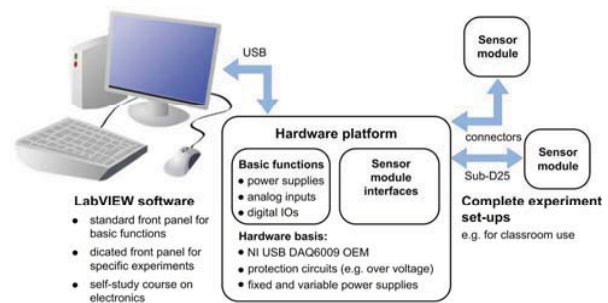


Figure 1. System Overview VenDASys

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Virtual flute: electronic device that uses virtual reality to teach how to play a flute

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Abstract— In this paper is described the process that should be done for developing a interactive tool for supporting the musical learning specifically on how to play a flute on its basics. This device has two main stages, the first one takes over the teaching part and guidance to the student by an software interface and the second one has the responsibility of captured how is being played the flute using a pressure sensor and reflexive transducers. With this example is expected to contribute in research and implementation of teaching devices around the world.

Keywords—acoustoelectric devices; computer applications; learning systems; music; technological innovation; virtual reality

SUMMARY

The learning and / or musical training are complex for many students because they do not have enough tools, for example they do not have someone or something that continually motivate and guide them for training in musical performance as a contemporary art. Also there are people who are subjected to inappropriate patterns of study for their skills and abilities in the learning process in this area. These factors cause dissatisfaction in a specific group that wants to work on their artistic abilities.

At the same time, it is seen in our society the need to develop teaching tools and technology of interactive models more efficient and attractive, making the learning process more enjoyable. The non Immersive virtual reality offers in this case, an option in which the interesting and useful interactive educational simulators are an innovative way of presenting to a student the information that is required to learn, giving the opportunity to be evaluated and followed throughout this process, leaving behind the traditional teaching, instead implemented a constructivist pedagogy.

Therefore it was decided to develop this tool that has an electronic device with educational software in order to guide the user through the process of learning how to play a flute.

The dynamic of the device has three stages a first one that gives all the instructions to the user, a second one where the hardware senses the note and finally a feedback of this data to the computer.

The software provides to the user the necessary information for learning how to play the notes and gives the opportunity to choose which one wants to practice. According to this decision, the computer sends to the electronic circuit the necessary data to identify what information it is waiting. The electronic device detects how the flute is being played using a microcontroller to capture data from sensors (air pressure and positioning of the fingers).

The results are analyzed and the circuit returns a message to the software which provides a correction or an acceptance of performance, thus completing a cycle of information and feedback aimed at the understanding and successful learning.

It is notice the importance of implementing tools which makes more efficient and effective the learning process as in this case in the arts and music pedagogy.

New technologies related to computer music make it possible to not only create new types of music by ourselves, but also to learn conventional music more easily [1]. An academic impact is generated because it explores in the interactive virtual reality related to music and this tool brings improvements in the research and implementation of this kind of devices which provide an innovative way of teaching that makes an easier and more interesting learning process.

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An adaptive Multi-Agent based Architecture for Engineering Education

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Abstract— This paper proposes an agent-based adaptive Architecture to extend Moodle in order to support instructional decisions and adaptive behaviour in engineering education. The paper describes the characteristics, functions, and interactions of the agents which take part in each module of the adaptive architecture. In addition, we describe the origin and function of ToDei, the proposed intelligent agent for Instructional Decisions Making. This agent is in charge of collecting information generated by the rest of agents and deciding what is best for the final users, tutors and students, taking into account their attitudes towards the learning environment.

Keywords: Intelligent agents; adaptive educational systems; intelligent systems; user modelling; tutor modelling

SUMMARY

One of the challenges of engineering education is to tackle with complex learning experiences which in many cases include the use of a diversity of tools and environments, drill and practice processes, virtual laboratories, etc. In this context, the use of adaptive content has been proven to be an important contribution to facilitate learning [1], provided as an extension of a given learning architecture. From all the VLE open sources available in the web, Moodle is the most widespread and used around the world.

The Moodle approach is based on three main components: the professor, the classroom in which the educational process is given, and the students. They work together in the following way: The professor looks for and produces all the information necessary for the course development. He/she organizes it in weekly blocks or thematic blocks and enters the topic orientation, the supporting resources and tools (files, documents, videos, audio, etc.), and the activities that must be developed by the student. Finally, this one is in charge of

developing the proposed activities, downloading or checking the resources and interacting with his/her partners according to the orientations received by the professor. The teaching-learning process is developed in the classroom, and the information generated here is stored in a relational database that is fed and accessed through the user interface. The Moodle's structure allows providing facilities in order to give each one of the student's different resources and activities, to give advice to students, and to facilitate the interaction between students to students, students to professors and vice-versa. If there is not information related to the user preferences, the navigation sequence, the document evaluation, and the knowledge level, the teaching-learning process will be developed in a general way for all the members of a course. And a personalized service will not be offered to each student. One alternative to such problems is to focus Moodle on students' needs, trying to adapt this system to each one of the students and training them according to their learning styles as well as adjusting the system to the students' needs. The proposed architecture is based on the main areas of adaptation defined in [2], providing presentation and navigation adaptation using intelligent agents associated to different modules in Moodle. This multi-agent methodology has recently appeared as a good companion of adaptive distributed educational systems.

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Session: 01G Area 3: First Year Courses and Programs

On Freshman Training of Engineering Students by Projects and DIY Activities

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Assessment of the learning competence of mathematics for first-years of the Computer Science degree

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Analysis of the results of four years of research and application of a student-centered system based on the ECTS to first-year students in order to improve their performance in the subject AC-I

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A Concept Map Approach for Introduction to Computer Engineering Course Curriculum

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On Freshman Training of Engineering Students by Projects and DIY Activities

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Abstract- This paper presents how to help engineering freshmen have a general idea of engineering and an overall understanding of what they are going to study. One project activity outside curriculum in a LEGO lab and two outside-classroom DIY activity cases are presented. After three years practice, students had more interest and passion in engineering and showed their talents.

Keywords- freshmen training, research-orientated education, engineering DIY activity

Summary

Engineering students begin their first year with fundamental science and pre-technology courses which give little knowledge about engineering. As a consequence of this arrangement, some of the freshmen have no general idea with what is engineering at the beginning of university study. This leads to the engineering freshmen lack of objective and interest when they are taking fundamental science and pre-technology courses.

This paper presents how to help freshmen have a general idea of engineering, to make them easier to have a overall understanding of what they are going to study in the future in

university, which technology courses they are going to take, and what those course are applied in the study.

To achieve this goal and to lead freshmen to understand the seeming hidden objectives of further learning, introducing preliminary engineering courses inside or outside classroom is of vital importance to the success of some freshmen, bringing them more interested in engineering major.

In this paper, one project activity outside curriculum in a LEGO lab and an outside-classroom DIY course are presented in details. After three years of practice, students show their talents on engineering projects in their early years in undergraduate programs.

The work of this paper is based on the cooperative program of Sino-France Engineer diploma, which is cooperated between Shanghai University and University of Technology (UT) network in France. The aim of this program is to bring up qualified engineers who can have a perfect performance in internationalized environment.

Assessment of the learning competence of Mathematics for freshmen of the Computer Science degree

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Abstract— Mathematics is an important core of the syllabus of any Computer Science degree. We have studied the relation between the learning competence of Mathematics for first-years at the Universidad Politécnica de Valencia, and their success in the subjects of mathematics in the degree. Its relevance for their success in the whole first academic year is also reported.

Keywords— component; Bologna Process, Competences, Computer science education, Management education.

Summary:

Before 2010, all the higher education institutions should have adapted their degrees to the Bologna Process. It has the purposes of promoting lifelong learning, widening access to higher education, and stimulating the mobility across the European Higher Education Area [1]. This change does not only consist on a new measurement of the credits of the subjects in terms of the student workload. All the contents of the new syllabus should be addressed to the achievement of prescribed learning outcomes and competencies [2]. These could be related to general skills or to specific contents of the syllabus of the computer science degree. In both cases, the initial level must be known and the desired level should be realistic. Therefore, an assessment of the initial situation is required.

A project supported by the Spanish Government has been conducted on several Schools and Faculties of Computer Science in Spain [3] in order to state the initial level of competencies of the first-years. Reading comprehension, English, and Mathematics were evaluated by analytic rubrics. The results can be compared with the Pisa reports of 2003 and 2006 [4].

At the Escuela Técnica Superior de Ingeniería Informática of the Universidad Politécnica de Valencia in Spain, we have compared the results on the Mathematics competence of this study with the students' success in Mathematics subjects of the degree, and in the whole first academic course. These results can also be compared with other studies conducted at this institution for first-years [5,6]. Besides, we also try to relate students who drop out of the institution after the first year with their initial level of competence [7].

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Analysis of the results of four years of research and application of a student-centered system based on the ECTS to first-year students in order to improve their performance in the subject AC-I

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Abstract—In this paper, the results of four years of a research aimed at carrying out a comparative analysis between the application of the European Credit Transfer and Accumulation System (ECTS) and the traditional teaching and learning system (TTLS) to first-year students, in order to improve their performance in the subject Analysis of Circuits I (AC-I) are presented. The ECTS is a student-centered system based on the student workload required to achieve the objectives of a program, and the outcomes of its application have been quite positive. In order to conduct the statistical analysis of the data collected in the educational experiment and make the right decisions, at the beginning of the experiment, during the first years, both treatment and control groups were formed and several tests of hypothesis were conducted in the groups that participated in the educational experiment. Neither all the students who took the above-mentioned subjects nor all the professors who taught them participated in the experiment. However, during the last year of the experiment all the students and almost all professors participated in the experiment. Since the beginning of the experiment, satisfactory partial results have been gradually achieved, and when we managed to involve all the students and almost all professors in the last year of the experiment, the overall results were not only satisfactory but also significantly better than the ones achieved in the previous years. The students satisfaction and confidence have increased gradually, and, in general, the students under the ECTS passed more exams and with better Grades than the students under the TTLS. Also, the teaching-learning methodology strategies, tutor sessions, assessment methods, use of the virtual learning environment (VLE), student teamwork, and collaborative work among professors performed better under the ECTS than under the TTLS.

Keywords - *student-centered learning system; first-year students; statistical analysis*

SUMMARY

In this paper the results of four years of research and application of a student-centered learning system (SCLS) to

improve the performance of first-year students (FYS) in the subject AC-I are presented.

The subject AC-I is a fundamental one and it is taught in the first semester of the first-year course in the EUIT de Telecomunicación at the Universidad Politécnica de Madrid. Also, the students that take this subject can be either new first-year students or students who are taking the subject again. Several educational experiments have been conducted in order to improve the performance of the students in AC-I, and their results have shown that when the academic results of one year are compared with the ones of another year the differences between both are not always significant.

In this paper the problem of analysis of the results of the educational experiment is formulated as a statistical analysis problem and some decisions about the efficiency of the proposed SCLS on the basis of sample information are made. Despite the fact that there were years in which there was not a significant improvement in the performance of the students and others in which the improvement was only slightly better, there were years in which there were highly significant differences. The best year was 2009 and the worst were 2005 and 2008.

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A Concept Map Approach for Introduction to Computer Engineering Course Curriculum

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Abstract— As in any discipline, in Computer Engineering, students start learning the basic concepts of the discipline in their first year through an Introduction to Computer Engineering course. The topics touched in this course can be grouped into two. The first group includes simple concepts like binary numbering system, hard disk, memory, and I/O devices. In the second group, an introduction to the courses that they will take in the next semesters of the program which includes programming, networking, software engineering, artificial intelligence and database systems. The main objective of this course is to give an introduction about the general concepts of the field to the first year Computer Engineering students and prepare them to understand the connections between them for their future studies.

However, students and instructors face with many problems in this course. First, because of the diversity of the concepts given in the course, it is very difficult for the students to see the big picture of the Computer Engineering domain. Similarly, it is difficult for the instructors to prepare the course content in an integrated manner at the students' level. Additionally, the perception of the theory and practice behind the hardware and software topics and their connections is not an easy task for the beginners. Moreover, the topics are mostly abstract topics, which does not allow application of any laboratory sessions. Students usually find this course difficult to understand, which decreases their motivation about the department and success of the course.

This study is established to propose a concept map approach to better visualize and discover all the connections between the concepts of Computer Engineering field which can be used in the curriculum of the programs and introductory courses of the field addressing the above problems. The proposed concept map helps to visualize the general picture of the field.

Index Terms—curriculum development, concept maps, computer engineering

SUMMARY

Because of the very nature of the rapidly changing technologies, several problems have been faced with for establishing the computer engineering curriculum. The curriculum of such programs need to provide theory and practice on basic concepts of the field such as hardware, digital logics, computer organization, and architecture, programming languages, operating systems, computer networks, database systems and data structures. As declared

by Nisan [1], the overall interactions among hardware, software, compilers and operating systems used to be simple and transparent enough for understanding computer systems. However the modern computer technologies have become increasingly more complex which makes it very difficult to understand the whole system of the computers [1]. Accordingly, this complex structure puts pressure on the designers of introductory courses [2] and curriculum developers of such programs.

This study describes the introductory course and the curriculum of the program. Then, it provides the proposed concept map for describing general tracks and dimensions of the field. For the development of the concept map, a new approach called "Goal-Question-Concept" is applied. Lastly, it shows the relationships among the introductory course as well as the curriculum of the program. We believe that, this concept map can be used as a base to build connections about different subjects given in the introductory course and can be introduced in each course to address the relationship between the content of the course and the whole program. This would help the educators to better show the connections between theory and practice issued introduced in a specific course and their connections with the field and prepare course content according to the concept map interactions. Also it would help the students to better build the connections among different concepts of the whole computer engineering program.

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**Session: 02A Area 3: Skills Development: Technical Writing, Presentation,
Teamwork**

Challenging Students' Responsibility: An Engagement Methodology

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**Analyzing self-reflection by Computer Science students to identify bad study
habits**

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Assessing Competency in Undergraduate Software Engineering Teams

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Challenging Students' Responsibility:

An Engagement Methodology

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Abstract— In order to challenge the students' responsibility this paper reports an action-based research about some ways to tackle such tasks for increasing their motivation and course engagement from a "teamwork" competence. Their comments and suggestions provide strategies to improve the results obtained.

Keywords: *Competencies, Formative Assessment, Rubric, Student's Opinion, Teamwork*

I. STATE OF THE ART

In the year 2010 will be completed the Bologna process (namely, European Higher Education Area –EHEA): changes in learning and teaching, in institutional and management levels. To improve the competitiveness of universities and the quality of higher education in the European Union curricula will be worked based on the professional responsibilities/academic competencies, the student's active and ongoing learning, the flexibility and the internationalization of studies, the introduction of the European Credit for transfer and accumulation (ECTS), the alignment of curricular structures in two cycles and the people's mobility. The graduate profile will be a benchmark reference of the new curriculum, which is being designed at present in the Spanish university, because it will have to establish the core (basic) competencies (standards for learning to learn and learning to know), crossed competencies (learning to live together and learning to be), and specific competencies (learning to do). That new curriculum will develop the spirit EHEA/ECTS: a Long-Life-Learning development profile of the student through a development of competencies (i.e., skills, attitudes, aptitudes and values). On the other hand, the valuation matrices (rubrics) are scoring guides used in assessing student's performance that describes the specific characteristics of a product, project or task at various levels of performance, in order to clarify what is expected of the student's work, assess their implementation and facilitate the feedback supply.

II. PROBLEM STATEMENT

This study analyzes the results provided by a cross-sectional study conducted in five degrees on the student's opinion regarding the competence of "teamwork." Also, it includes public and private universities of the Basque Country land. As a consequence, this paper reflects over ways to engage (in an action-research environment) undergraduates in motivation, participation and responsibility tasks challenges, since they are

not accustomed to work such skills. Besides, such values are rarely treated in the first and second courses of the any university degree.

III. METHODOLOGY

The methodology has been built up a team of educational innovation that has analyzed the competitive team from four affinity groups with a total of 42 evaluation criteria: the structure (11), process (10), relations (11), emotions (5) and evaluation (5). The performance indicators to be considered have been agreed, and a protocol has been established to give students understanding throughout their formative evaluation process. The competency has been developed in diverse scenarios: which is here considered deals with a Statistics syllabus through course short projects, worked from the perspective of an active learning methodology such as PBL/EBL.

A survey has been designed to analyze the student's perceptions regarding the approach, development, assessment and competence analysis from the students' viewpoint. The items considered take into account aspects such as: the information provided, the training involved, the initial level of expectation with respect to the competence, the degree of development reached, the development of the teaching methodology applied, the tutorial action (in the sense of facilitation) applied and the global assessment deployed. The results of this survey are presented in this work to help refocus the teaching methodology with which that competence will be worked in the future.

IV. RESULT DISCUSSION

Formally, these results demonstrate the need and urgency that the students show to introduce it in their lives. To emphasize again, the student's opinion is analyzed over a given competence, using such a synergy to promote students' motivation, accountability and participation via challenges.

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Analyzing self-reflection by Computer Science students to identify bad study habits

Self-reflection performed by students of programming courses on the study habits and skills acquired through b-learning supported by an automatic judge

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Abstract— We present some preliminary results and the main conclusions of a study that we conducted at the University of Algarve, for one of the programming courses in the first year of the Computer Science degree at the University of Algarve. We analyzed the self-reflections made by the students about their study habits and about the skills they acquired in the course. This particular course uses a methodology of blended-learning supported by an automatic judge. The research data were obtained through questionnaires that were distributed and collected during the period of study between the end of classes and the exam. We took into account data from other instruments related to previous work carried out by students, in this course and in previous courses, as well as the performance of the students. We intended to ascertain to what extent the planning, motivation, previous study or knowledge about the type of examination influenced final results. The results suggest measures to be implemented in future editions of the course.

Keywords- *Blended-learning, automatic judge, self-reflections, study habits and acquired skills of programming students, learning constrains.*

SUMMARY

In general, the Portuguese student population enrolling in a higher education computer science course is mostly composed by young adults (say, 18-19 year olds). These students bring with them, from the beginning of secondary education and also from other experiences, knowledge, experiences, skills, attitudes, study habits, motivations, interests and expectations, and also the weaknesses referred in [1], that we must not ignore. Still, these motivations, interests, and expectations do not always have the desired effect in achieving academic success within the prescribed time. Furthermore, it has been observed that accumulated failures as a result of difficulties in developing the necessary skills for writing programs that require more than superficial knowledge lead students to stay at the university as adults (say, with more than 24 years of age). We believe it is the teacher's responsibility to encourage students, young adults and adults, in building a deep, responsible and autonomous knowledge for the adoption of

rich, diverse, motivating and demanding strategies from a cognitive point of view [2] and to identify those factors that are necessary pre-conditions for the development of those skills. Therefore, we adopted a methodology based on Blended Learning, supported by an automatic judge that assesses and partially grades the programs written by students and thus freeing teachers for other more rewarding tasks. At this point, we questioned study habits and acquired skills of programming students, during the classes and in their preparation for exam, in an attempt to identify learning constraints and to enhance the student's attitudes in future editions of course. Therefore we analyzed self-reflections of their learning, based on a sample of students that performed the exam in the academic year 2008-2009. The research data were obtained through questionnaires. We took into account data from another instrument on a previous study performed by students in the current academic year, as an important factor in the acquisition of programming skills and balance, to overcome any limitations in the current study. The main goal of this research was to determine to what extent the planning, motivation, previous study or knowledge about the type of exam influenced the final results. The results indicate the existence of conditioning factors in achieving success in some students, especially in relation to their study habits. We also found weaknesses that suggest, in future editions of the course, the need for advice or help in demonstrating how to acquire the key skills to enable students to "make the jump" to progress in learning.

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Assessing Competency in Undergraduate Software Engineering Teams

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ABSTRACT

From 2005, Active Learning in Computing partners Newcastle and Durham University (ALiC), part of the UK CETL initiative [1] introduced a collaborative learning model of Software Engineering to level 2 Computing Science students that reflects global industry practice by focusing on cross-site software development. Assessment for our respective modules focuses on measuring the students' development of both the technical and transferable skills associated with the practice of being a software engineer. This cross-site model encourages greater student engagement with the discipline and reflects industrial practice in a more authentic way by incorporating real industrial problems and practices. Since the new model of working has been implemented, students have reported good learning outcomes in questionnaires and focus groups set up to evaluate the module design and their experiences.

During the project teams are formed at Newcastle and each one is then paired with a corresponding team at Durham. The major project task is the design and implementation a large software system – (e.g. in 2005 the task was a tour guide application that could be loaded onto a PDA or mobile phone and in 2007, teams had to develop a virtual geocaching application). Students work together as a virtual enterprise across the sites using communication technologies to facilitate their collaboration. Skills outcomes for the module were and still are listed at Newcastle as: initiative; adaptability; teamwork; numeracy; problem-solving; interpersonal communication; written communication and oral presentation. The assessment scheme is formulated around measuring student development of these skills during the module [2]. Their level of proficiency or achievement of these skills is decided based on the quality of teamwork products, team presentations, peer assessments, and staff observations which receive a grade at the end.

Assigning marks to students during and at the end of the module[3] means that student achievement “is abstracted into just a few numbers” so it is difficult for the student to perceive what skills they have learned and how these skills have developed during the project based on marks and feedback on lots of separate elements of coursework. How do they know how good are they at being a software engineer? What skills do they need to improve on? What are their strengths and

weaknesses? We propose that assessment should focus on the development of a range of competencies similar to those identified by Turley and Bieman when conducting a study of exceptional and non-exceptional professional software engineers [4]. Competency levels could be measured via peer, self, formative and summative assessment in a style that relates directly to professional performance appraisal. Turley and Bieman identified 38 competencies including – helps others, willingness to confront others, responds to schedule pressure, focus on user/customer needs, is team-oriented and writes / automates tests with code. We would use these in conjunction with the assessment of technical and team work products to give students a more useful and realistic performance review of their competency levels and how these have changed and developed throughout their project. In this paper, we review the assessment methods currently used to evaluate student performance and measure learning outcomes. We outline a set of alternative competencies and appraisal methods that could be used instead. We define how these methods could be used to help students achieve greater understanding of the requirements of their chosen profession in a global context and to help staff and students qualitatively evaluate levels of achievement and skill development in comparison to these during undergraduate team projects in Software Engineering.

KEYWORDS

Software Engineering, Competency, Skill development

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**Session: 02B Area 3: Knowledge and Competencies Management -
Competencies**

**A knowledge based analytical model of propaedeutic cycles for higher education
in Colombia**

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**The influence of design problem complexity on the attainment of design skills
and student perceptions**

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**Business and Management Competency of Engineers: Curriculum and
Assessment**

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Authoring Learning Contents, Assessments and Outcomes in an Integrated Way

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A Knowledge Based Analytical Model of Propaedeutic Cycles for Higher Education: Linking with Media Education in Colombia

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Abstract— A mathematical model and a computer system are described in order to analyze the curricular coherence of the study plans and the linking between the propaedeutic cycles from the media and basic levels to technical professional, technology and superior levels for the Colombian educational system.

Keywords-component; Propaedeutic cycles, Curricular coherence, expertise, Curricular knowledge management, ICT

SUMMARY

A Knowledge based system model to face the new methodological strategy on Higher Education in Colombia is presented: the propaedeutic cycles. A great challenge is presented to Superior Education Institutions: to establish the link between traditional cycles: technical, technology and professional ones with the secondary, basic and media levels. Our solution is presented linking each phase with a propedaetic component discussed in a model. The model is dialogically integrated by cognitive and informational components.

A structural system to determine and analyze the cohesion and coherence of the propedaetic cycles between competences and the curriculum knowledge. This construct enables curricular knowledge management inside the media and higher education. Several types of matrices are developed; firstly regarding columns: the longitudinal one in time (semesters); secondly the cross one grouped by curriculum subjects, (additionally each cell of them can be expressed by fuzzy values); thirdly regarding the structure: the input/output for optimization purposes.

An individualized model of student productivity (iCOACH) to be integrated to counteract the stereotypes which considers the technical and technological cycles as relegated careers in higher education. This model is an intelligent knowledge based one which was validated with a software prototype just implemented in the FESSJ. This construct has as its mission the guarantee of quality assurance of student's propaedeutic cycles.

A multidimensional flexibility system supported on university autonomy for managing student, pedagogical, and curricular

knowledge which enables the management of the heterogeneous and complex environment; this subsystem is intended to ensure continuity and permanence of the student.

The earlier is framed within a construct of curriculum knowledge and information. From this it is intended to reduce the high complexity of the harmonization and articulation of the propaedeutic cycles which face the universities when undertaking these projects. Moreover, it is pursued to offer major clarity to the educational community and in this way to contribute to the democratization of the involved knowledge within this methodological strategic articulating efforts according to the policy of the Colombian Government which seeks not only to increase the educational population but also to a major access of the marginalized social population and of those of lower revenues in order to fulfill the right to information executed by the National Constitution of this country.

Abbreviation and Acronyms:

ICT: Information and Communications Technologies
FESSJ: SAN JOSE SUPERIOR EDUCATION FOUNDATION at Bogota Colombia
FESSJ-PROP: The FESJ Institutional Model for the Higher Education Propaedeutic Cycles
PEI: Institutional Educational Project
iCOACH: Intelligent knowledge based systems for individual student productivity
Edumatic: Educational Computing
Cognimatic: Knowledge Computer Education

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The influence of design problem complexity on the attainment of design skills and student perceptions

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Abstract— One of the current educational challenges is how do we educate engineers to systematically solve open-ended real-world design problems? The capstone design course often plays a critical role in this, but there are numerous questions on how best to teach design and what are the characteristics of realistic design problems which provide excellent learning opportunities. This paper reports on a controlled evaluation of the effects of design problem complexity on students' ability to functionally abstract a design problem and its effect on their perceived value for variety of design methods. It is important for students to learn a systematic approach to the design process and to perceive its effectiveness. Students' perceptions and functional modeling skill are measured. Results, while preliminary due to limited sample size, indicate the complexity of the design problem is a critical factor in teaching design methods. There is a statistical interaction between the complexity of the design problem and opinion of functional modeling on their ability. Results also indicate that students who work on more complex design problems are more likely to expect to use functional modeling in the future. More complex design problems lead to a more positive student opinion. Further development of the functional modeling quiz is needed as is a larger sample size. Overall, results indicate that more complex design problem demonstrate to the students the effectiveness of the methods.

Keywords- Design methodology; engineering education; functional modeling

Summary

The senior capstone design course plays an important role in teaching engineering students a systematic design process to enhance their innovation skills and guide them in applying their technical knowledge to real-world problems. The capstone design experience is viewed as a critical part of the undergraduate engineering curriculum but there is little agreement on how best to teach design to undergraduates [1].

This paper explores one aspect of the capstone design course, the design problem complexity and how it influences learning and student perceptions. The complexity of a situation (design problem) has been shown to affect skill development in other domains such as accounting . One critical design skill is the ability to select useful abstractions, generate them and use

the results to guide their designs [2]. Functional modeling is one class of methods focused on creating abstractions of a device. A function is what the device does independent of a particular form. Students' perception may influence how well they learn a particular design skill and the choice of using a particular design method in the future is often up to the designer. The paper employs a controlled experimental comparison of teams working on a more complex design problem (a lunar rover) to teams working on a less complex problem of only a single module of the lunar rover.

The complexity of the design problem does affect student perceptions and their functional modeling ability. More complex design problems result in more positive student perceptions. Results indicate there is an interaction between student opinions and the complexity of the design problem that affects their functional modeling ability. This effect needs to be further explored with a larger sample size since in the current experiment the Simple Condition contained only 14 students.

When the goal is to teach students the design methods, for example in a first design methods & theory course, more complex design problems should be used. More complex design problems clearly demonstrate the effectiveness of design methods.

There are numerous other desired learning outcomes such as the ability to troubleshoot problems and make accurate assumptions that are not measured by the current study. This study evaluates a single design skill but many other skills are also critical to the design process. Future work will also focus on these other skills and other issues associated with implementation of capstone design.

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Business and Management Competency of Engineers

Curriculum and Assessment

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Abstract— It is a global trend that those engineers who are proficient with the principles of business and management are rewarded with leadership roles. With the growing interdependence between technology, industry, economy and society, more opportunities will be available for engineers to exercise their potential as leaders, not only in business but also in the nonprofit and government sectors.

In this paper, the following questions are addressed: What does it mean for engineers to have business and management competency? How can engineering schools prepare their students to attain the type of business and management competency demanded by industry? The analysis presented in this paper addresses the above questions in the following ways. First it defines the meaning of business and management competency for engineers. Second, it offers a minimum learning criterion for the business and management competency of engineers and a set of three learning outcomes of engineering management education. Third, this paper shows the results of an industry demand survey for engineering management education as well as provides a review of the global educational trends in this field in the U.S., Japan and Korea. Finally, the leading examples and lessons learned from engineering management education at Yonsei University are presented, and recommendations are made.

Keywords- *engineering management; business competency; learning outcomes; accreditation*

Authoring Learning Contents, Assessments and Outcomes in an Integrated Way

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Abstract— Developing learning material is a tedious task mainly due to two factors: their variety and their cycle of continuous update. Based on the utilization of DocBook for developing material, a solution is proposed to solve both problems. The proposal is to establish a special markup inside the DocBook format that permits to define multiple kinds of learning material in the same macro-document.

Keywords— component; DocBook, authoring, learning material, learning assessment, learning outcomes

SUMMARY

In the context of learning material development there are two aspects that make this task cumbersome for the authors. The first one is the variety of the materials. Authors have to create units of learning for the students, scripts for the classes, test for assessment purposes, practical sessions, simulations, problem sets, flashcards (what we are calling *learning pills*), etc. Besides, all these documents can contain multimedia materials. Due to this variety of learning materials, their production becomes quite complex. The second problem is the cycle of updating materials. It is not easy to update all the references to a concrete subject that has changed. This is particularly a great problem in the technology environment because updates are more often than in other knowledge areas.

Some authors use standard formats for developing learning content. The DocBook format [1] is a schema maintained by OASIS [2] for books and papers that can be also used for the development of learning content. The objective of this paper is to present a special markup used in the DocBook format to provide it with a series of features that can solve the main problems of material authors. This markup also takes into account other aspects in a preliminary stage, like learning outcomes and objectives management and generation of evidences that prove these learning outcomes. That is, the author will be able to develop different learning materials in the same document; thus, the creation process has been improved because the author can reflect whatever comes to his/her mind in the same document and just in time.

The author has to follow a set of markup instructions in order to indicate what type of material he/she is creating. A great macro-document is the result of this process, which will be post-processed conveniently in order to obtain the set of documents that the author intended to create. XSLT [3] technology has been used for this post-processing purpose, so a

series of templates (one for each learning material type) have been developed. In the development, the considered learning material types have been: units of learning (student lessons), assessments, learning pills and problem sets.

The markup defined for the DocBook format provides the following features:

- Possibility of indicating the learning outcomes associated to a content section.
- Definition of variables that can be evaluated all across the document. This feature alleviates the problem of continuous material update.
- Introduction of multiple choice and true/false questions that can be used in assessments. These special questions can include also other metadata like hints, duration or indication of incompatible questions.
- Possibility of defining learning pills in the macro-document.
- Creation of sets of open questions from this same macro-document.

In order to test the validity of this development it has been integrated into the tool of material production ADA [4]. In the near future it will be used to create material for some subjects in the Carlos III University in the second semester of the current course (2009-2010).

ACKNOWLEDGMENT

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Session: 02C Area 2: Innovative Engineering Courses and Labs - Laboratories

Developing an Optical Spectrum Analyzer

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A new Systemic Methodology for Lab Learning based on a Cooperative Learning Project

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An Experience of a Multidisciplinary Activity in a Biomedical Engineering Master Degree

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An Undergraduate Microwave and RF Low-Profile Laboratory

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Developing an Optical Spectrum Analyzer

Realizing a complex embedded system with student groups

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Abstract— Within the curriculum of the Bachelor Electrical Engineering there are obligatory lab experiments for electrical measurement. As an alternative to the standard course projects for interested students are offered. In one series of projects an Optical Spectrum Analyzer (OSA) is going to be realized by students. The complete opto-mechanical hardware was sponsored by a company and groups of students develop additional components to complete the OSA. After the development of each OSA subsystem it is planned to combine these together with software for a complete OSA. The consistently positive feedback from the students is encouraging and it is planned to expand this type of project.

Analog circuits; Educational technology; Electronics engineering education; Optical spectroscopy

I. INTRODUCTION

In the study course Bachelor of Electrical Engineering there are the lectures Electrical Measurement part 1 (in the second semester) and 2 (in the fourth semester) with the laboratory courses Electrical Measurement part 1 (in the third semester) and 2 (in the fourth semester) where groups of students carry out experiments for gaining practical experience. During the lab course 1 some basic skills like handling measurement instruments and doing elementary experiments are taught. In the second lab course more advanced experiments are done.

II. SCOPE OF PROJECT

In the Electrical Measurement lab course 2 some especially motivated student groups asked to develop electronic components within an own project. Therefore a series of projects for developing an OSA were started.

Within these projects the students train practical engineering skills which are essential for their professional life. They see the difference between theoretical knowledge and practical application. For many of the students it is their first hardware development within a team and they learn how to divide a project into different work packages, carry them out and combine them to a complex device.

The technical basis for this professional training is the development of a working OSA which has challenging electronic building blocks. The goal is to finish an OSA with working hard- and software to use it for lab education.

The opto-mechanical hardware for the Optical Spectrum Analyzer and a laser source were sponsored by JDSU. The I/O-Board for connecting the OSA to a PC was sponsored by National Instruments.

III. REACHED PROJECT STATUS

Up to now the main building blocks of the OSA electronics were developed and tested. The following hardware projects for the OSA are realized:

Summer semester 2008:

- Linear transimpedance amplifier

Winter semester 2008/09:

- Logarithmic transimpedance amplifier
- Motor driver using a microcontroller
- Driver electronics for wavelength reference LED

Summer semester 2009:

- Positions sensor electronics
- Motor driver using analog electronics

Winter semester 2009/10:

- Connecting the hardware parts and creating a control software using LABVIEW

IV. PROJECT FEEDBACK

The students gave the following feedback of the projects:

- “The project was very interesting due to the different tasks. It was very good to see the results and the success”
- “It is better than lab courses with fixed experiments because of a higher motivation, learning from own mistakes, having a free time schedule”
- “The disadvantage is a higher work load than doing standard lab experiments”

We saw a very high motivation of the student groups. The results of the written test at the end of the lab course were better than the tests of the students with fixed standard projects.

V. PLANNED WORK

Due to the high success of this project type we offer in the meantime other topics. In the middle future we intend to switch the whole lab course from fixed experiments to project work.

A new Systemic Methodology for Lab Learning based on a Cooperative Learning Project

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Abstract—The idea of this paper consists of developing a new methodology based on a complex system that will be analyzed and programmed by several groups of students that must work openly and cooperatively to achieve a final global result. For this purpose, a personal digital assistant developed as an open hardware called OpenMoko has been selected. The paper details the experience of working with this system and highlights the main obtained benefits.

Keywords- systemic methodology; cooperative projects; open hardware; lab learning.

SUMMARY

Cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject [1]. One of the main benefits of cooperative learning is that learners can improve their ability in the subject and learn to adjust their interpersonal relationships through interactions with other group members [2]. On the other hand, project based learning (PBL) is an educational teaching and learning methodology has been actively used for some time now. Compared to traditional lecture-based or teacher-centered engineering curriculum, the PBL model inspires a higher degree of involvement [3].

This paper proposes the combination of both concepts in an electronic lab subject using a complex system in which both learning strategies are developed. Openmoko™ is a project dedicated to delivering mobile phones with an open source software stack. The Openmoko stack, which includes a full X server, allows users and developers to transform mobile hardware platforms into unique products.

I. METHODOLOGY DESCRIPTION

The proposed project is to build an application for an Openmoko phone able to connect to a beacon (implemented in a PC) which provides a kind of information pages through a Bluetooth link. These pages are very simple and can contain texts, menus and sounds. Due to the complexity of the project, four subgroups were created: Subgroup 1: Bluetooth, Subgroup 2: Graphic Interface (QT), Subgroup 3: Sound Interface, Subgroup 4: Accelerometer. In the first few sessions the teacher explains some introductory lessons about the GNU/Linux operating system, the Openmoko platform and the development tools. In order to facilitate the work both inside and outside the classroom, the teacher created an image of a

GNU/Linux distribution with the toolchain installed so that the students could use it by simply installing an open source virtualization platform. This allows students working in their own PCs with the same environment without having to change their O.S. or spend time installing the toolchain and setting up the environment. The following sessions were dedicated to the project's development. The obtained results are next detailed:

Subgroup 1: The students managed to establish a connection between the Openmoko phone and a computer by using Bluetooth's SDP profile and RFCOMM protocol. The SDP profile was used to publish the specific service so that the devices belonging to the system can connect between them without bothering devices that do not belong to the system. For the data transfers, the students used the RFCOMM protocol, since it provides a serial-like link. They also designed a specific application layer protocol intended to be run on top of RFCOMM. This way they can send easily simple files describing the data that should be displayed on the Openmoko terminal.

Subgroup 2: They managed to build simple windows on demand, at runtime, using QT as the framework for developing the graphic user interface.

Subgroup 3: This subgroup built a basic sound infrastructure based on mplayer that was able to play both local files and streams.

Subgroup 4: The students managed to retrieve the accelerometer's data and do a simple post-processing on the data to detect certain movements. This way, the user could change the selected item in a menu by simply moving the phone upwards or downwards.

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An Experience of a Multidisciplinary Activity in a Biomedical Engineering Master Degree

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Abstract— Training Biomedical Engineers presents major challenges because of the different backgrounds they are coming from. These activities should stimulate student's professional skills, and in the particular case of a Master Degree this is even more complicated. It represents a higher educational level where students should increase and improve their ability to solve problems related to very different areas such as the engineering and biomedical. The Biomedical Master Degree shared between the *Universitat Politècnica de Catalunya* and the *Universitat de Barcelona* has students coming with extremely different backgrounds, from the medical or biological to the engineering profile. Taking into account this situation, we have developed a *4-days multidisciplinary charge activity* in a particular course of Biomedical Devices, focused on the amperometric sensors and in the conception and application of biopotentiostat amplifiers. Regardless the student's profile the activity is focused in such a way that everyone has to work actively in the experience. This paper presents a proposal based on co-operative learning strategy and the feedback that students give to the learning process as a first approach for future improvements.

In the design of the experience different objectives are pursued. One is the development of an integrative laboratory experience that promotes inquiry, relevance, and hands-on experience for the students.

The activity is not conceived just like a lecture in class. This activity is based on the lecture, but it is just one more element. Thanks to the activities in the classroom and the laboratory, some other aspects are reinforced, like the communication and team work between the students, working in teams, and a more hands-on approach to learning is developed.

The presented activity, where we presented and developed a cyclic voltammetry (CV), is designed in order to work different aspects related to the students' activities (ECTS credit transfer), and to

work specific objectives in the course, which are the interest to present the feasibility to carry out electrochemical experiments controlled by a PC, and make noticeable how works the instrumentation used to interface the electronics with the experience.

The activity is based on the use of the amperometric electrochemical sensors to carry on a voltammetry experiment, based on the use of a three-electrode setup. The students work in the architecture of the potentiostat, which is a grounded working electrode, identifying the different modules. They work the principle of the operation and they must understand the limitations derived from the used amplifiers. As amperometric sensors are used, it is also presented the concept that the current generated in the cell is related to the concentration of the electroactive species, with a 5mM $K_3Fe(CN)_6$ solution.

This paper presents this proposal, the approach followed and the feedback that students give to the process to the teachers.

Some key aspects are derived from the survey. As the main result, the presented activity has been evaluated as quite valuable for all the students.

We have detected the need to increase the feedback between the electronics students with the rest, because it is very difficult for these last students, without a good background in electronics, to work fluently with the circuits. It is important to point out that all the students understand and assimilate the concept of the important link between electronics and the experience, and their impact in biomedical applications.

Keywords-component; Multidisciplinary Teams, Amplifiers, Analog Circuits, bioengineering education, Cyclic voltammetry

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An Undergraduate Microwave and RF Low-Profile Laboratory

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Abstract— In this work, we present a complete set of undergraduate microwave and RF laboratory experiences, that have been designed to improve the students competences on the high-frequency design, analysis and characterization. The developed courses include one-port and two-port circuits' measurement and characterization with the current most used instruments: vector network analyzers, spectrum analyzers, noise figure analyzers and power-meters. The computer-aided design has not been overlooked: a *design-optimization-fabrication-measurement* process is proposed to improve the students' global vision of the subjects.

Keywords- *microwave circuits; antenna design; low-profile laboratory; computer-aided design and simulation; microstrip lines.*

SUMMARY (HEADING 1)

Last decade has been characterized in education of electrical engineering for an overwhelming development of web-based software and/or CAD programs for low-cost simulations of technological phenomena. Two positive consequences have been derived from this fact: firstly, budgets devoted to the acquisition of new laboratory equipment could be reduced - especially in recent engineering campuses-; and, secondly, subjects related to computer engineering have increased their presence in electric engineering syllabus. But also negative facts have appeared as a drawback: on one hand, a high percentage of graduate students are not able to translate all the theoretical knowledge to real-world and, on the other hand, the academic formation in specialized areas of electrical engineering, such as high-frequency and microwaves, has decreased. This communication presents the development and adjustment of a low-profile laboratory for teaching high-frequency and microwave techniques in Electrical Engineering. As it was pointed-out in [1], special attention has to be paid to these laboratories, according to both the high cost of the electronic equipment and difficulties to achieve realistic designs and high-precision at these frequency ranges.

The high-frequency laboratory has to be useful for different courses of the Telecommunication and Electrical Engineering degree, all of them in the undergraduate last two years (the students are assumed to have a consistent knowledge of

electromagnetic theory and analogical circuits and systems). First of the courses to be taken is a basic course on microwave theory and techniques, including passive and active circuits design, as long as S parameters analysis and measurement. Parallel to this subject, a second one course is related to antenna theory, design and characterization, including radiation wave propagation measurements. Finally, an advanced course on microwave circuit design, including circuit components of wireless transducers such as low-noise amplifiers (LNA), oscillators and mixers is also developed. According to their main theme, two sets of experiences have been developed for the antenna and microwave laboratory:

A. Microwave technology.

- Two-port S parameters characterization of active and passive high-frequency circuits using a Vector Network Analyzer (VNA).
- Microwave circuit characterization of passive and active devices using spectrum analyzers and power-meters.
- Noise measurement and characterization of active and passive devices.
- CAD of high frequency passive and active circuits [2].
- Microwave passive devices design and fabrication.

B. Antennas & Propagation experiences.

- High-frequency laboratory equipment for one-port measurements.
- Practical measurements of antenna parameters and propagation effects.
- Measurements of in-site radiowave spectrum.
- CAD of high frequency wireless communications.
- Fabrication & measurements of antennas.

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Session: 02D Area 2: Laboratory Experiences: on-site and remote environments - Remote Labs

Easily Integrable platform for the deployment of a remote laboratory for microcontrollers

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A Remote Laboratory to Promote the Interaction between University and Secondary Education

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SecondLab: A Remote Laboratory under Second Life

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Hardware Implementation of Remote Laboratory for Digital Electronics

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Easily Integrable platform for the deployment of a Remote Laboratory for microcontrollers

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Abstract—Remote laboratories are the natural solution in order to perform real experimentation under e-learning tools. Nevertheless these tools are the result of the research developed by the universities to cover their own needs without having in consideration the deployment of this technology by other institutions. This paper presents a hw prototype for a Remote Lab for microcontrollers that tries to solve these problems contributing new possibilities from the commercial and professional point of view.

Remote laboratory; e-learning platform; microcontrollers

INTRODUCTION

The use of Remote Laboratories in universities is extending widely. A Remote Lab is a combination of hardware and software which allows a student to complete lab assignments remotely, e.g. from his home, just as if she was present in a laboratory. The student remotely controls the devices in the laboratory through a web interface, and monitors the outputs resulted from her interaction through a WebCam, a data file or using other electronic measuring instruments like oscilloscope or multimeter.

Many universities have developed remote labs that are used in teaching certain subjects [1]. These systems provide a learning tool that can be placed between the software simulator and real experimentation. The complexity of the developed platforms, as well as the particular dependences of the specific infrastructure of every institution impede to export these systems to other study centers lacking the expertise necessary to deploy these systems for themselves.

WEBLAB-DEUSTO-PIC V2.0

In the Faculty of Engineering of the University of Deusto play the role of users and developers of Remote Laboratories. This dual perspective has helped us realize the difficulties in designing a remote laboratory but also on problems that arise from daily use of these systems.

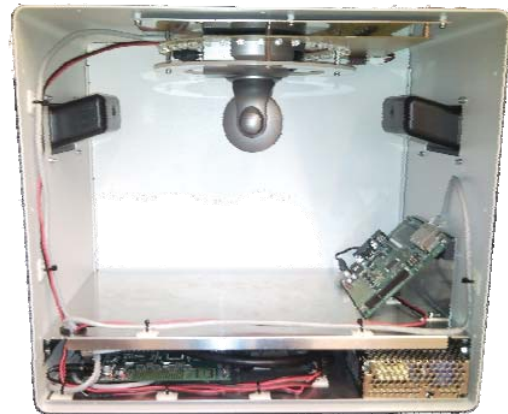


Figure 1. WebLAB-DEUSTO-PIC V2.0

As a result of this experience we have designed a remote laboratory for helping in learning the “Microcontroller based System Design” trying to make it easily deployable in any institution.

The system has been designed pursuing three key characteristics:

- *stability*, giving a robust and professional aspect to the laboratory
- *adaptability*, providing the operation under different modes that allow the system to operate autonomously or under the supervision of a software platform as WebLab-Deusto,
- *extensibility*, thinking about the deployment of other laboratories under the same platform for the learning of other technologies such as CPLD or FPGA.

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The authors would like to acknowledge to the Spanish Science and Innovation Ministry for the support in the project TIN2008-06083-C03/TSI “s-Labs – Integración de Servicios Abiertos para Laboratorios Remotos y Virtuales distribuidos

A Remote Laboratory to Promote the Interaction between University and Secondary Education

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Abstract— iLabRS is a remote laboratory developed in Telecom BCN, the Telecom and Electronics Engineering School of the UPC with the key participation of a Secondary Education technology teacher. Students and teachers can access to real experiments in the electronics and physics areas using a web browser. The remote experiments have been designed to partially cover the technology curriculum in the last two high school years with a triple goal: (1) to enrich the set of laboratory experiences available in High Schools, (2) to provide a clear example of the possibilities of internet-based technologies and (3) to promote the interaction between University and Secondary Education. Currently, 13 different experiments can be performed. A pilot evaluation experience was carried out, with 7 High Schools and around 100 students participating. In the experience assessment, the students gave a mark of 3.8/5 and the teachers of 4.4/5.

Keywords- Remote laboratory; Secondary Education; Student engagement

SUMMARY

Engineering studies, and more specifically, Information and Communication Technologies (ICT) related higher education studies have suffered a decrease in the incoming students from Secondary Education in the last years. Several initiatives are being carried out, mainly in the western countries, to promote the technological and engineering vocations. In ETSETB-Telecom BCN, the Telecom and Electronics Engineering School of UPC, in Barcelona, an existing modular remote laboratory platform has been adapted to provide remote access to real experiments to Secondary Education students, as a way to increase their technological knowledge and skills but also to promote the interaction between the Secondary Education and the University. To do that, a key factor has been the collaboration between the Telecom BCN staff and Francesc Garófano, a Secondary Education professor that spent a full sabbatical year in the development of both technical and didactical aspects of the remote laboratory. Remote laboratories are widely extended [1], [2] in the University. In the secondary education, however, almost all internet-based experimental resources are based on simulation.

iLabRS has been built over our modular platform [3] to develop remote laboratories in the instrumentation and sensors field. It is based on a main board which provides a custom

acquisition system around an Ethernet-capable microcontroller. iLabRS structure consists of several main boards, each of them with its own IP address, connected into a LAN through a switch with a dedicated server. This server is in charge of running the NI - LabView programs which implement the user interface and control to perform the experiments. Teachers or students can perform experiments using a web browser to access to the iLabRS web site (<http://ilabrs.etsetb.upc.edu>), which contains didactic materials for each experiment and also the url to the LabView remote panel which gives the control of the experiment.

At this time, up to 13 remote experiments corresponding to the Technology curricula of the two last High School years can be performed. To perform each experiment, students can download and study didactic materials. Through the remote panel students can select, configure and run experiments. Data collected let them to answer the didactic guide questions.

A pilot evaluation experience was carried out. Seven High Schools were selected and their Technology professors were contacted. Most of them visited the School with their students to see the physical lab. Around 100 students participated in activities using the remote lab. A web survey with 8 quantitative questions was prepared. The students gave an average mark of 3.8/5 and the teachers of 4.4/5.

Nowadays, work is focused on developing new experiments (a robotic arm, an hexapod robot based on shape memory alloy, lamp bulb efficiency measurement,...), implementing more replicas of the existing experiments and designing a more complete software to manage the secure access and the resource organization for large groups.

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Francesc Garófano has devoted a sabbatical year paid by the Education Department of Generalitat de Catalunya to develop this project. The second phase of the project had a grant from EnginyCAT project, SOC-FSE.

SecondLab: A Remote Laboratory under Second Life

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Abstract— The present work describes the implementation of a new remote lab, SecondLab, that allows students to control a microbot from Second Life. SecondLab works over WebLab-Deusto, the remote lab of the University of Deusto, giving the students the chance to work with real experiments from a social 3D-based immersive environment. This approach places the remote lab closer to the students, trying this way to increase their motivation to study science and engineering.

Keywords- Remote experimentation, Second Life, e-Learning

I. INTRODUCTION

The newest learning trends suggest both entertainment and highly immersive environments as a way to achieve an effective learning process. The present work follows this line to try to solve the current decrease of enrollments in scientific and engineering-related degrees. To achieve this purpose, SecondLab takes advantage of the technical possibilities of remote labs and the increase of popularity of social immersive environments among teenagers.

II. SECONDLAB

SecondLab is a remote lab that allows students to program a microbot from Second Life. Thus, it is a remote lab that offers a real experiment inside a virtual world.

The following steps describe SecondLab:

1. Log in Second Life and go to the SecondLab laboratory.
2. Press the START button when SecondLab is available.
3. Upload a program file to the microbot.
4. Wait until the screen in front shows the microbot working under the programmed orders (see Fig. 1).

SecondLab has been designed as an experiment inside the distributed architecture of WebLab-Deusto. In the server side, this has involved the development of a microserver implementing the API that every microserver in WebLab-Deusto must implement. This microserver is the only software module depending on the microbot, so it is the responsible for interacting with the microbot via Bluetooth. In the client side, it has been necessary to build a 3D laboratory in Second Life and implement both the events related to the user interaction and



Figure 1: Watching the microbot in SecondLab

the XML-RPC communication layer to interact with the WebLab-Deusto server side (see Fig. 2).

III. CONCLUSIONS AND FUTURE WORK

SecondLab proves that it is possible to mix virtual worlds with real experimentation in a first approach (prototype version). However, it also proves that developing a remote lab for end-users under Second Life is not recommended due to its serious technical limitations: poor scripting language, limited user interface components, memory restrictions and lack of high-level communication protocols.

The main future plans for SecondLab are to improve the autonomy of the microbot and to offer two real microbots for two students simultaneously, so different competitions could be organized in order to increase the motivation of the students.

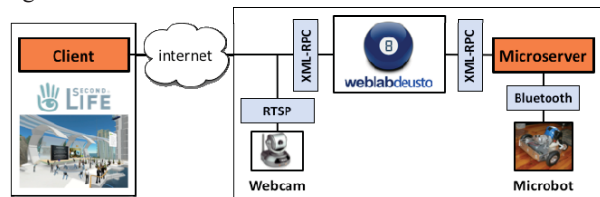


Figure 2: Architecture of SecondLab

The authors would like to acknowledge to the Spanish Science and Innovation Ministry for the support in the project TIN2008-06083-C03/TSI "s-Labs – Integración de Servicios Abiertos para Laboratorios Remotos y Virtuales Distribuidos" and to the Regional Government of the Basque Country for the support in the project SAIOTEK S-PE08FD03.

Hardware Implementation of Remote Laboratory for Digital Electronics

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Abstract— This short paper presents a new hardware system that lets develop labs of Digital Electronics. The system is focused on the verification of logic functions, so teachers can create new experiments only changing the problem proposed, within the range of input variables and output functions that system supports. The students have to solve the problems finding and simplifying the functions. Then, they must implement the results in the proposed system.

Keywords - logic design; laboratories; practice assesment

SUMMARY

This paper shows how an experiment about realization of logic functions using logic gates can be performed with a flexible, computer based hardware. This system is initially designed for used in remote labs, but can also be used “in-situ” for normal labs.

This work is a demonstrative part of the Project S-Labs “Open services integration for distributed, reusable and secure remote and virtual laboratories”, sponsored by Spanish Ministry of Education and Science. The main objective of this Project is to integrate technologies for learning theoretical and practical using any Learning Management System (LMS) [1].

The proposed system has several characteristics that make it different from other existing remote laboratories.

First, the experiments can be performed using the services offered by the LMS used by any University involved in this project. Then this remote laboratory will be a new resource, like other material published in Digital Electronics Courses over the LMS’s. With this feature we don’t need to create again the basic services that a remote laboratory uses, like administration, content packaging, etc., because they are included in all LMS.

For teachers, has the advantage of being able to share the laboratory between different departments or Universities, with little investment and, of course, a sharing policy. Then the system can be fully productive.

For students, the main advantage is the use of the familiar environment provided by the LMS, so make remote practice becomes easier.

On the other hand, the second important feature is that the system allows the realization of logic functions without restrictions, so you can perform many different practices. With few changes you can prepare different experiments for different groups of students, or you can change the remote practice from one course to another, avoiding that student’s lab results could be passed on to “next year” students [2].

The physical system has four main parts:

- A computer, for control of the correct performance of practices and the lab server.
- The function board, that performs the logic functions. It’s based on LSI integrated circuits, and its main parts are an AND gate array followed by an OR gate array, with programmable connections. With this circuit you can generate up to 4 functions of 4 variables each.
- A digital acquisition board, which programs the circuit, enters the values of the variables and reads the generated functions.
- A webcam, which is used to receive visual feedback from the function generator circuit.

All these elements are housed in a desktop PC case, so that the laboratory is a compact set well isolated from ambient light interference and possible mishandling.

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**Session: 02E Area 5: Lifelong Learning and Nontraditional Students -
Theories and Courses**

**Knowledge Management and Professional Profiles in Electronic Systems
Engineering**

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**Scientific project management course introduction in doctoral studies in Riga
Technical University**

Galkina, Alina;Kunicina, Nadezhda;Ribickis, Leonids
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Introduction to Electronics as a Minor Subject

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**Role of Faculty in Promoting Lifelong Learning: Characterizing Classroom
Environments**

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Knowledge Management and Professional Profiles in Electronic Systems Engineering.

The Function of University-Industry Collaboration

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Abstract—This paper reviews some of the knowledge management techniques applicable in the electronic systems engineering sector, it also proposes a professional profiling method for engineers and discuss the role of university education in the shaping of optimal profiles.

Keywords: *knowledge management; engineering education; professional profiling, electronic systems engineering.*

ABSTRACT

The predominance of electronic technology in countless sectors and application areas is requiring companies outside the electronics sector, for which electronics is not their core business, to apply this technology in their products. In addition, some branches of electronic systems engineering are changing at so rapid and sometimes so disruptive a pace that it is very difficult to recruit, train and maintain human resources dedicated to tracking, selecting and applying the technology. These two main factors are driving the tendency to totally or partially outsource to external consulting and engineering companies the development and life cycle maintenance of the electronic systems incorporated in products and solutions.

An electronics engineering consulting company can be viewed as a knowledge processing factory. It uses knowledge as its raw-material (research results and education from universities, internal R&D and collaborative projects, collaboration with universities and technological centers) or as a semi-elaborated product (components, subsystems, tools, technologies, produced by specialized companies all over the world, or even free software and hardware projects and communities) and generates applied knowledge as output. Its role is to process and internally manage this knowledge and to apply it properly in its client's projects.

The results of an engineering project are evaluated based on the achievement of the cost, quality and deadline objectives established by the client. Electronic systems engineering has to satisfy very demanding requirements for those three

parameters. Complex requirements have to be met, time to market reduced, and it is necessary to deal with limited budgets and design to cost constraints. To meet these requirements it is essential to apply the right type of knowledge, at the right moment in time, and with the right intensity, in every task and during every stage of the project.

We first discuss competence and competency management and propose a professional profiling approach which is multidimensional, fine-grained, partially inspired by the spectral representation used in engineering and physics, and indicating the difference between the frequencies at which the skills have to be renewed and consolidated [1].

We then review some of the knowledge management techniques applicable in this context, paying attention to the dynamics involved and to the application of knowledge in the overall process of an electronics systems development and deployment project [2, 3].

Finally, we discuss the role of university education in the shaping of optimal profiles, and the forms of collaboration between universities and engineering and consulting companies, and review some specific cases, involving the University of the Basque Country or the Spanish University for Distance Education (UNED) with its ability to provide education and training to active professionals.

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Scientific project management course introduction in doctoral studies in Riga Technical University

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Abstract - Research activity is an integral part of the study process and it is to be noted that many of the research programmes are very important for the industry and economy of Latvia.

Keywords - *Scientific project management, doctoral study innovation, research and development*

SUMMARY

Riga Technical University (RTU) is open to world-wide co-operation in scientific research and in education for sustainable development of knowledge based society. It provides general information on different fundamental and applied research projects carried out in our academic and research units. It also gives the names of our academic staff members as well as institutions involved in particular research areas.

RTU not only University, but in the same time research organisation, which leads technological development in Latvia.

The RTU strategic priority is to archive 30% incomes of budget from scientific projects, that's way involving PhD students in regular research work, is important for RTU sustainable development.

The doctoral students mainly become main researchers in RTU, so it is important to educate doctoral students, in time of doctoral studies and involve them into financially successful research.

The innovative idea commercialization process is difficult for doctoral students. There are stereotypes and non structured knowledge that they have at the beginning of course. At the end of course they become skilled young researchers with structured knowledge about ways and possibilities to realize commercialisation of their research results.

The knowledge structuring for doctoral students is one of three critical components to start scientific project, based on scientific research in doctoral studies. The other components is

scientific research, with possibility to gate such final product, with ability to sell it on real market, mainly it should be new device, material or computerised program. The research results should not be too theoretical. The last component is ability of young scientist to work.

Development of doctoral studies at RTU promotes the development of human resources and helps to improve the situation on the enterprises developing the ideas ready for commercialization.

Doctor studies play an important role in the training of scientific staff for sustainable development of Latvian economics. The application of project based learning approach in doctoral studies is main instrument to reach acceptable level of industry in Latvia. The analysis of case study of IEEI, which is a leader in RTU in project-based learning application shows, that such strategy application could increase the financial resources of institution more than two times. Research projects in the field of power electronics and electrical engineering. The annual scientific report informs on the main branches of the research activities, contact information of the staff, scientific results and the present scientific infrastructure. Special attention is devoted to the Doctoral students who will provide the development of science in future as the basic workforce.

The course helps doctoral students to structure they research, and to imagine process from the beginning of the research to commercialization. The main response was that the course research more sustainable and motivates doctoral student's also commercial applicable result after doctor studies.

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Introduction to Electronics as a Minor Subject

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Abstract — **Technical knowledge should not be limited to computer scientists and engineers. Also people outside these professions should have a basic understanding of technical concepts, trends and challenges. This paper describes a module of electronics for technical journalists and shows that electronics can be successfully communicated finding a balance between simplification and accuracy.**

Keywords – **electronics, technological literacy, life-long learning, educational methods**

I. INTRODUCTION

Technology has a major impact on today's life. Electronic circuits help us through the day, starting in the alarm clock that wakes us in the morning and the radio that gives us the news during breakfast. And the electronics in a smoke detector guards us during the night.

However, the impact of electronics on our lives and the economy is contrasted by a lack of interest in society as a whole. People outside engineering and computer science are often unaware of the role modern electronics plays. There are a number of reasons why we, the engineers and computer scientists, should try to change this situation. If we want appreciation or remuneration for our work, we need people to understand what we do and where our work has an impact. Furthermore, visibility of our profession draws prospective students. And we also want to interact with society and discuss the risks and benefits of new technologies.

The paper reflects teaching electronics as a minor subject and gives experience based on a course held for technical journalists. The same approach could be used for students studying economy, law or political science.

II. EDUCATIONAL OBJECTIVES

While for every course its objectives should be defined, this is especially important when teaching a broad topic in limited time. For the course of electronics as a minor the following educational objectives were defined. The students shall,

- be able to explain basic terms and components in the field of electronics,
- know the main tasks in design and manufacturing of electronic circuits,

- be able to assess new information about trends in electronics.

However, it must be noted that it is no course objective that students shall be able to design electronic circuits themselves. This will not be their task in their aspired professions.

III. OBSERVATIONS AND EVALUATION

As personal impressions during teaching students showed significant differences in their abilities and motivation. Some students are already familiar with electronics, while others are very reluctant to engage with the subject.

This heterogeneity has been anticipated and cared for when structuring the course into different topics. For the weaker students it has shown to be helpful repeating important concepts several times. Students with previous knowledge were eager to discuss advanced problems.

Also a formal evaluation has been undertaken, to investigate to what degree students accept complex topics. The evaluation showed that students accept small frustrations and give good ratings when they realize that they can transfer the knowledge they gained outside the classroom.

IV. CONCLUSION

The basic concepts of electronics have been successfully taught as a minor subject to non-engineering students. Key to the lecture is a strong focus on the educational objectives, accepting that students will not design electronics themselves. They rather have to comprehend and assess information about electronics and be able to professionally interact with engineers and computer scientists.

In addition to other technological literacy courses, the economic impact of electronics is emphasized, linking the course content to other subjects. Also this provides the application for the students, as their assessment of technology will be based on economic merit.

Organizing the course into clearly differentiated topics allowed coping with the heterogeneity of students. To students with previous knowledge, more advanced information could be given, while enabling students with little previous knowledge can catch up at the beginning of a new topic.

Role of Faculty in Promoting Lifelong Learning: Characterizing Classroom Environments

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Abstract— Calls for educational reform emphasize the need for student-centered learning approaches that foster lifelong learning. To be a lifelong learner includes characteristics consistent with those of self-directed learners, such as being curious, motivated, reflective, analytical, persistent, flexible, and independent. Educational research has shown that the building of these aptitudes involves a complex interplay among nearly every aspect of human development. Instructor support of students' self-directed learning (SDL) development relies on understanding and balancing these factors in the classroom. Engineering educators play a critical role in influencing outcomes related to SDL through their design of courses that support students' transitions from controlled to autonomous learning behaviors. This study will examine a variety of engineering courses and pedagogical approaches. Each will be characterized using instructor course information, videotaped classroom observations of instructor-student and student-student interactions, student and instructor responses to surveys, and focus groups. Finally, the students' capacity for SDL will be measured using the Motivated Strategies for Learning Questionnaire. This approach should provide for rich, contextualized descriptions of what instructors and learners do, how instructors and students relate to each other, and how students view their classrooms. This work-in-progress paper will describe our initial work in this multiyear study.

Keywords- Lifelong learning, Self-directed learning

SUMMARY

Designing learning environments and activities that engage students in self-directed learning (SDL) and foster the growth of autonomous individuals is not a simple task. With its introduction of program outcome (i) "a recognition of the need for, and an ability to engage in lifelong learning," as a requirement for all engineering graduates, ABET essentially challenged engineering educators to determine how we may best engage students in SDL (and eventually lifelong learning). To effectively promote SDL, faculty need to be skillful in facilitating pedagogies that engage students in self-direction, be sensitive to and understand student attitudes and behaviors in SDL settings, and be aware of the roles that classroom environments can play in aiding students' SDL development.

The limited existing studies show no significant gains in undergraduate engineering students' capacity for SDL via traditional instruction [1]. However, nontraditional instructional practices such as problem-based learning are more explicitly designed to develop student attitudes and skills relevant to SDL and there is some literature support to suggest that these approaches are more effective at developing self-directed learners [2]. There remains, however, little empirical data on those factors that promote SDL amongst undergraduate engineering students, especially from carefully designed studies using validated instruments. This multiyear investigation seeks to fill that gap by conducting an observational study that examines a range of engineering environments, carefully characterizes instructor practices regarding support of student autonomy, and examines the relationship between classroom environments and proxies for lifelong learning such as SDL behaviors and attitudes.

This study will examine a variety of engineering courses and pedagogical approaches. Each will be characterized using instructor course information, videotaped classroom observations of classroom interactions, student responses to the Learning Climate Questionnaire, and instructor responses to the Epistemic Beliefs Inventory. Focus groups and student dialogue from the videotaped classes will be used to gauge students' perceptions of the degree to which the learning environment supported their autonomy. Finally, the students' capacity for SDL will be measured using the Motivated Strategies for Learning Questionnaire. This approach should provide for rich, contextualized descriptions of what instructors and learners do, how instructors and students relate to each other, and how students view their classrooms.

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Session: 02F Area 4: Pedagogies

The development of professional mentoring for engineers undertaking a workbased learning Masters degree

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Cooperative work and continuous assessment in an Electronic Systems laboratory course in a Telecommunication Engineering degree

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Intelligent evaluation in educational context

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Meaningful learning checking of concepts related to equations and functions in Physics Chemistry according to the main theme gas laws.

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Professional Engineer Recognition

The development of professional mentoring for engineers undertaking a workbased learning
Masters Degree

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Abstract—a method of recognising and assessing learning at Masters Level alongside the monitoring of engineering competence development in the work-place is described. For successful participants in the programme the outcomes lead to a Masters Degree and recognition as Chartered Engineers in the United Kingdom. The paper concentrates on the monitoring of professional development and competence assessment through the work of appointed Professional Supervisors.

Topics: *Area 4: Active Learning, Area 4: Learning Models, Area 4: Pedagogies*

Keywords: *mentoring, workbased, competence, pedagogy, professional*

In 2008 Kingston University, London initiated a new MSc Professional Engineering program undertaken through work-based learning, in collaboration with the main UK engineering regulatory body, the Engineering Council UK.

How and why this initiative to develop a new learning model has come about is explained alongside how it has provided an innovative approach to the mentoring of developing engineers. In particular the authors concentrate on the theme of competence monitoring and how professional supervisors interact with participating engineers.

The process of providing learning targets is summarized. These develop the necessary knowledge and understanding at Masters level within individual learning contracts. Also, presented in more detail, is how the competences necessary for Chartered Engineers are monitored and assessed.

The underpinning theory of mentoring we are using is explained together with details of how industrial mentors are brought into the mentoring process alongside professional supervisors appointed by the university. Also explained is the pedagogy of problem based active learning that we have developed within this program.

The current structure of the role and responsibilities of the professional supervisors is clearly spelt out and explained with details of their activities, training and reporting mechanisms.

The very positive feedback from both employers and participants that has been forthcoming is explained with the help of relevant case studies. Due to the many large UK and global companies that are impressed by the motivation of their employees, the paper describes how an international support and mentoring strategy is being developed specifically to support participants globally.

Cooperative work and continuous assessment in an Electronic Systems laboratory course in a Telecommunication Engineering degree

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Abstract— Electronic laboratory courses offer the possibility to introduce some specific and transversal skills to the curriculum of the students who follow an engineering degree. This paper examines the methodology and assessment which is applied in the laboratory course of the subject “Electronic Systems” in the second year course in the Telecommunication Engineering degree from the Castelldefels School of Technology (Escola Politècnica Superior de Castelldefels, EPSC) at the Universitat Politècnica de Catalunya (UPC). During 14 laboratory weekly sessions of 2 h, students must analyze and design the analog and digital circuitry for an ultrasound-based distance measurement system, by means of several guided practices. Small groups of two or three students worked on a collaborative way, while the teacher acted as a guide to facilitate project comprehension and knowledge acquisition. The experience we describe corresponds to the Spring term of 2009, a period in which this methodology was applied to two small class groups of about 23 and 7 students respectively. This work studies the influence of the initial characteristics of the students and their time devoted to prepare the subject, on their academic performance. The paper finishes with a list of recommendations in order to improve students learning process and course assessment.

Keywords- Collaborative work, electronics engineering education, circuit analysis, circuit simulation

SUMMARY

It is well known that main general skills that enterprises demand for graduates of engineering programs are: teamwork, creative thinking and communication. To accomplish these requirements class activities must be learner-centred and teachers must become guides in the learning process. The variety of skills that engineering students should master is increasing. There are several pedagogical methods that have been adopted in response to these needs [1]. Students who work cooperatively tend to exhibit better grades, better analytical, creative and critical-thinking skills than students taught in a traditional style [2]. Cooperative learning is the instructional use of small groups for students to work together to maximize their learning and that of their peers. Among the advantages of working cooperatively in small groups we can mention that it reinforces learning and improves skills and

social relationships. It is a way of making students active cognitively.

The present work is focused on: methodology (cooperative work and portfolio) and continuous assessment applied in the laboratory classes of Electronic Systems in the second year course (year 2000 Curriculum) in the Telecommunication Engineering degree from the Castelldefels School of Technology. This study corresponds to the Spring semester 2009 which has taken into account 30 students, divided in two laboratory-groups of 23 students (Group A) and 7 students (Group B) respectively.

This work relates the academic performance with the initial characteristics of the students, obtained from the analysis of the responses to a questionnaire that was given to the students the first session of the course. The highest percentage of students who passed the subject occurred in students coming from the baccalaureate or who had repeated the course and no clear correlation between overall academic performance and admission mark to the university was observed.

Students were asked to evaluate how much time they had spent studying for this course. Taking into account the information given by the students and the marks obtained, we conclude that they don't spend enough time preparing the subject. This study also shows that the relationship between the time devoted to prepare the subject (inside and outside the class) and the marks obtained by the students are not correlated. Although there is no direct relationship between time and marks, some students would improve results if they made a more effort.

Most of the students have had a favourable impression of the methodology applied in laboratory classes.

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Intelligent evaluation in educational context

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Abstract—The idea is to conceive an intelligent computing system of decision-making aid, in this context of teaching training, the quantification of the human behaviors is the key to this system's innovation. Seeing that it gives opportunity of measuring the professional acts of the teachers in class. This makes it possible to locate these practices compared to the pedagogical theories, into force and especially compared to the constructive approach. In addition, this system helps to identify the student's styles of learning; therefore it places, at the disposal, information which facilitates to the teachers the adaptation of their pedagogical methods so that the student benefit a maximum assimilation.

For what concerns them, the students also profit from an innovating alternative: result of the web based performances analysis in summative evaluation. It is a generated report, for each pupil, automatically at the end of the seizure of the marks stipulating in details their weak points and specifying the adequate remedies in terms of activities to be realized to proceed to reflexive regulations in order to raise their levels of assimilation. An able system, starting from observable behaviors in classrooms and of performances seized remotely via the Web, to quantify in a rational way the cognitive and emotional states of the actors of the context of teaching training. An expert system whose general objectives would be: classifying the profiles of the teachers starting from their professional competences based on their pedagogy, behavior and attitude, classifying the learners' profiles by analyzing their interactions and analyzing their performances in summative evaluations, adapting the resources of the teacher's pedagogical methods in order to have a better coherence with the profiles of identities, the profiles of motivation and the profiles of comprehension of learner.

Keywords- Evaluation, statistics, fuzzy logic, learner profile, teacher profile

Meaningful learning checking of concepts related to equations and functions in physics chemistry according to the main theme gas law

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Abstract — In this article, the authors propose an investigation of the learning process of the concepts and of the mathematical relations in the physical chemistry study of the gas, mapping an interdisciplinary teaching approach. The theoretical background of the research is based on the Theory of Meaningful Learning (ML) and on Gowin's Epistemology trying to relate events, facts and concepts with other elements of knowledge through the "see" heuristic. The research experiments are being conducted with chemistry graduating students at the Universidade Federal de Pelotas in Rio Grande do Sul, during one semester, but it is planned to extend the studies to the engineering courses. The tests to check the subsumers are based on some theoretical questions related to the mathematical concepts already mentioned. Preliminary results of the testing show arithmetic and algebraic disabilities in a percentage of the group, as only 60% of the students answered the tests correctly. Based on the answers analysis contextualized activities are proposed to enrich the mathematics application in chemistry with the objective of favoring the development of the subsumers needed to the comprehension of the PC phenomena studied.

Keywords- *Physical Chemistry, Mathematics, Meaningful Learning, Interdisciplinarity*

SUMMARY

The study of Physics Chemistry (PC) is related to the knowledge of mathematical concepts concerning arithmetic, functions and graphics by the learner. In this article, the authors propose an investigation of the learning process of the concepts and of the mathematical relations in the physics chemistry study of gas laws, mapping an interdisciplinary teaching approach.

The development of the work was based on an investigative study about the learning and teaching process concerned with the Meaningful Learning Theory [2], its association with Conceptual Maps [3] and the relation between them with Gowin's Epistemology [1]. The studies were initiated with the realization of a pre-test in order to verify the mathematical knowledge that the students have about: the meaning of an equation, function, its differences and relations, independent and dependent variables, operations about the set of real numbers, quantities directly and inversely

proportional and the applicability of mathematics in the chemistry area and, more specifically, in the ideal gas equation in the subject of Physics Chemistry I.

At the same time, interviews with the professors were realized in the Universidade Federal de Pelotas (UFPel) and at Universidade Federal do Rio Grande do Sul (UFRGS), about the main difficulties found by the students in the applicability of the mathematical concepts. The interviews showed some common difficulties as: in the solving of equations, in the interpretation of inverse quantities, in the representation of functions, among others. One aspect told by the professors is related to the adequacy difficulty of the available graphical software in relation to the aim and needs of the specific subject of Physics Chemistry I.

The pre-test with students of two groups of the Physics Chemistry subject was realized in the beginning of the second term of 2008 and 2009 to verify the existence of subsumers related to the mathematical functions and equations. It was consisted of expository questions and activities to be solved about the math contents needed to the understanding of the ideal gas Law. The results showed that most of the students have difficulties to apply, analyze and interpret the mathematical concepts used in problems applied in the subject in question.

Based on the initial results, in the second term of 2008 a decision to work in an interdisciplinary way was taken. For that some monitoring activities of the practical classes in the subject were realized by a mathematics professor. During the laboratories classes the Mathematics and Chemistry professors participated in the process realizing the connections between the two areas in a way to highlight the applicability of the math concepts in chemistry.

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Session: 02G Area 1: Learning Objects reusability and digital repositories

Authoring Environment for E-learning Production Based on Independent XML Formats

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Technical congress proceedings as a reusable digital objects educational source

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Virtual analog and digital communications laboratory: LAVICAD

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Open educational resources (OER) inspire teachers and motivate students

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Authoring Environment for E-learning Production Based on Independent XML Formats

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Abstract— E-learning content production has faced the problem of making content independent from authoring applications and delivery platforms. Both aspects are very relevant to the need of keeping learning institutions as much independent as possible from software vendors. Content independence and interoperability is also required to easily share and move e-learning repositories. We propose a user friendly authoring environment based on the independent, open and XML compliant product Docbook; its simple, flexible and well structured markup make it easy to interoperate with other XML languages, particularly those related to e-learning. We are particularly interested in IMS Content Packaging and IMS QTI because they allow importing learning material into our Sakai based Learning Management System named PoliformaT. Docbook has also a powerful and fully customizable set of XSLT styles sheets that allow high quality web and paper delivery. The user front end is built on the commercial XML editor from XMLmind XXE. The major part of the environment is portable to other XML editors because it relies exclusively on Docbook components. At the moment the proposal presented is much more flexible, usable and productive than the available alternatives.

E-learning; interoperable format; XML; IMS; Docbook

SUMMARY

In this work we present a learning content authoring environment based on the XML compliant and open product Docbook. The main interesting features of Docbook are its well structured and format independent definition, its total independence from particular software products and vendors, and its complete set of mature and well tested web and paper format generation tools. The simple and well structured Docbook markup simplifies its interoperability with other XML compliant standards, particularly those oriented to import and export e-learning content in Learning Management Systems (LMS).

We present an extension the customization presented in [1] oriented to interoperate with IMS Global Consortium Standards, particularly IMS Content Packaging (CP) and IMP Question and Test Interoperability (QTI).

The ability to easily produce IMS CP and QTI is a key feature for us because our university has based its e-learning support on a Sakai customization named PoliformaT and Sakai uses these two IMS standards to import and export content modules and assessments, respectively

We have been using the proposed e-learning production environment since course 2005-06. We have authored three subjects with it.

A. Environment use

The procedure to produce a subject is to decompose it into modules or themes. Every module is created using the <article> template inside XML XMLmind Editor (XXE). The content of a module is organized into sections, commonly up to a three level deep section tree. Inside a section the content is organized into <simplesect> elements that are terminal sections in the document tree. A <simplesect> can be seen as a slide and contains an optional title and a sequence of content elements like paragraphs, items lists, tables, images, etc.

Exercises are included inside a <sect> or <simplesect> element using the <qandaset> container. Exercises are authored filling the <question> element with content elements (paragraphs, item lists, tables, images, etc) that define the exercise enunciate. If the exercise is a test question then the last element in <question> has to be one <options> element that defines the multiple choices for the test question.

A video demo is available at [2] showing how to produce IMS CP and QTI from a module using the proposed tools embedded inside XXE.

B. Learning impact

The switch from using presentation slides and exercises collections provided only in PDF format, into our new approach has had a noticeable impact in the learning process. IMS Content Package format allows including more active elements like videos and applets. QTI allows a more dynamic way of publishing exercises, together with the capability of publishing exercises with or without solutions from a single content source. Finally, the procedure to produce written exams automatically by reusing exercises already published and tested has improved quite noticeably the quality of written exams and this is greatly appreciated by students.

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Technical congress proceedings as a reusable digital objects educational source

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Abstract — The use of technical articles in scientific and academic scopes is a well-known way to extend new creations and researching jobs throughout the world, mainly as a communication way of knowledge among educational professionals. Nowadays, the Internet, with no doubt, is the usual way to spread any kind of documentation. The presented communication shows a way to use technical conferences information as learning objects to reuse them in a educational scope.

Keywords - learning object; reusable content; metadata; technical article.

SUMMARY

Due to the Internet magnitude, it's unlikely a document of interest to be easily accessible if an edition is made by the author on his own. In that case, using conferences as knowledge platforms it's more convenient. In a conference, the technical communications compose the whole congress edition, which is normally oriented to particular matters. Authors send the contents of their publications, using textual descriptions and graphical support elements. These parts of the document are conformed in a unique data unit, which only if some congress query media are developed, it's successully possible to access to article information.

The experience shows by the content of this paper, offers a way to spread the technical information from conferences and gives a solution to this access problem and bases its development on the information treatment of a conference as digital learning objects. By this way, a technical paper is treated as an information unit which is composed by a data background, essentially the metadata, which are recovered and isolated in every individual documentation.

Once a digital object and its metadata are disposed, congress edition conform a structured data block, accessible not only in the

congress scope but outside it. The use of metadata standards, as IEEE-LOM, let to information being built in digital platforms and repositories to be treated as congress information, as an individual article and even, some of its parts, as reusable digital objects.

We will propose some example of electronically managed technical congress documentation as well some different ways to increase the dissemination and use of the contents by means of a procedure that includes treatment, extraction and use of metadata to conform the digital objects from the main text and the components as graphics, illustrations, diagrams, etc. All this components, as well as its related metadata are disposed in a organized file structure, from where these elements act as data sources to create new scopes for the use of them in an open courseware environment, as well as the automatic creation of a web that maintains so the data as the metadata to be used to access the objects and the information they keep in a quick and effective way.

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Virtual Analog and Digital Communications Laboratory: LAVICAD.

On line interactive tool for learning communications systems.

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Abstract— The virtual analog and digital communications laboratory LaViCAD has been designed at the UPC and it results a useful tool to verify different communication systems performance and also signal processing techniques, subjects given in courses typically included in the curriculum of any electrical engineering degree. LaViCAD tool has become a flexible, sustainable and on-line freely offered educational platform and it can be updated whenever new content is required. At pedagogical level, the use of a virtual laboratory facilitates the learning of certain matters, acting as a connection between the theoretical contents of a communications system course and their practical understanding and experimentation. Furthermore, LAVICAD provides resources for professors to organize different teaching activities in their courses. These activities can be used in different environments as for instance in a classroom given in the context of a full attendance course or in a homework activity at a distance learning course.

The aim of this paper is two-fold: On one hand to describe the main technical features that make LAVICAD an original fully reusable and reprogrammable tool in signal processing and communication systems courses. On the other hand to show some preliminary academic results obtained with the use of LAVICAD verifying how it improves the level of success.

Keywords—component; Virtual Laboratory, e-learning, reusability, User friendly environment, Web-based labs.

SUMMARY

Some theoretical concepts and definitions in a communication system course contain a high level mathematical background. Sometimes the students must develop long paragraphs of mathematical formulas in order to demonstrate a theoretical result. In general, in a basic communication system course the student is faced for the first time to topics that are classified as very difficult by the students. As opposite, when they experiment in an instrumental laboratory, they can verify some implementation errors and misalignments that are inherent to hardware or real time software applications. In this context a graphical and interactive simulator tool can help them to understand better the differences and the similarities between a theoretical result and a real experiment. An accurate designed application tool available to verify a great diversity of communications systems and subsystems can become a powerful and useful learning help. The key idea of the use of LAVICAD consists in its functionality as a bridge from theory to Lab experiments. This idea is shown in Figure 1.

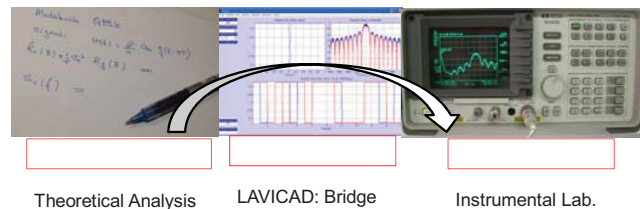


Figure 1. Key Idea: LAVICAD as bridge from theory to practice.

In the last years, the use of virtual labs has spread through engineering education environment with some innovative teaching techniques. Some experiences applied to signal processing and communication system have been presented in Figure 1. With LAVICAD, two main advantages are fulfilled. On the one hand the reusability feature to generate whatever new exercise is proposed by the teacher, on the other hand some of the LaViCAD experiments are freely offered in an educational moodle based platform: comweb.upc.edu. The user can access and execute locally without any other software requirement than the JVM (Java Virtual Machine).

The simulation tool LAVICAD has been created to serve in the learning process of the most important basic topics and the most popular advanced topics integrated in a second-year graduate-level course in electrical engineering. The great variety of situations, flexibility and possibilities of emulating the different and not always predictable practical effects in a real laboratory, make of this virtual laboratory a powerful tool that faces the student to problems with different difficulty levels. This tool also constitutes a challenge for educators, who can consider it as a complement or as a substitution of a real and experimental laboratory.

From a user point of view, LAVICAD is formed by an on-line set of four generic and basic communications systems (Digital Modulation, Analog Modulation, et c.) and two popular communications system physical links systems (WiFi and the digital video broadcasting DVB for digital terrestrial television). Consequently, up to the date there are six LAVICAD Link Level Simulators (LLS) currently working.

Paper Outline — after an introductory section, a description of the laboratory tool programming process is presented in section II. In section III we present three cases of use for three kinds of learning activity with different degrees of user interactivity. Section IV is dedicated to explain as the use of some LaViCAD systems in a theoretical and practical communications course has improved the academic scores. Finally, some conclusions are presented in section V.

Open educational resources (OER) inspire teaching and learning

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Abstract—Open educational resources (OER) can significantly reduce the time required to prepare lectures. The prerequisites are that a desired resource can be found quickly and that its adequacy for the intended purpose can be estimated easily. Eventually, the resource should also be suitable for modification. In the first part we outline the requirements for the sourcing, storing, retrieval and exchange of open educational resources considering technical and legal aspects. In the second part we present a case study focusing on the user level perspective. We describe the searching for a particular OER (an online Moodle tutorial), the analysis of the resource found, its modification and the publishing of the modified resource on a repository.

Keywords—open educational resources; repositories; metadata; learning objects; learning design frameworks; open access; community of practice;

SUMMARY

A. Open educational resources and repositories

Open educational resources are digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research [1]. In order to be accessible from all over the world, open educational resources must be made available on servers connected to the internet, so-called repositories. An exemplary collection of open e-learning content repositories can be found on the website of the Open eLearning Content Observatory Services OLCOS [2]. OER repositories must comply with standards in order to allow the exchange of the descriptions (metadata) of the educational resources stored in their databases. This is accomplished by means of the open archives initiative protocol for metadata harvesting OAI-PMH [3].

B. Retrieving open educational resources

Appropriate metadata are needed when we want to find open educational resources on a repository because we do not have access to the full text of all resources. Obviously, metadata are mandatory for multimedia resources such as images, audio or video in order to be able to find appropriate content. The IEEE Standard for Learning Object Metadata (LOM) is very well suited for the description of educational resources [4].

C. Using and reusing open educational resources

The intention of open educational resources is the reuse by other teachers. However, according to [5] about 80% of the users of MIT open course ware content are students and self-learners. In order to be widely reused, open educational resources must be suitable for modification. Therefore, they must include the content itself, appropriate metadata, and a documentation that points out the structure of the resource from a didactical and a technical point of view. Only reusable data formats have to be selected for the representation of content: Unicode for text, Tagged Image File Format for images, MP3 for audio and MPEG4 for video. As the Portable Document Format PDF cannot be modified using open source software, it is not a reusable format. Open Office documents should be used instead. For the representation of complex resources such as online courses HTML and XML are adequate.

D. Creating and modifying open educational resources

For the production and modification of online courses an authoring framework is needed. HTML pages can be edited with an easy to use Web authoring tool. The ReCourse Learning Design Editor is appropriate for dealing with more complex resources [6]. Last but not least institutions must support their faculty in the production and publication of open educational resources. Furthermore, the establishment of a community of practice would be of great value within and amongst institutions.

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Session: 03A Area 2: Innovative Competitions and Laboratories - Detectors and robotics

Developping of Low Cost Capacitive Sensors for Laboratory Classes

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Development of a Wiimote-based gesture recognizer in a microprocessor laboratory course

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Hands-on intelligent mobile robot laboratory with support from the industry

Chuang, Sheng-Hsiung;Huang, Hsin-Hsiung;Huang, Jheng-Yu;Lee, Chyi-Shyong;Su, Juing-Huei

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Cybertech: Robotic Competition and Subject

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Developing of Low Cost Capacitive Sensors for Laboratory Classes

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Abstract—This work presents an approach to the education in sensors, targeted to future engineers that relies on using educational sensors. An analysis of major issues on sensor education is carried out and two types of didactic, capacitive and low cost sensors are presented, which allow the student to easily understand the physical principle of the measurement, as well as to evaluate other sensor features like repeatability, sensitivity and measurement uncertainty. To this aim, some capacitive sensors have been developed to measure levels of oil and water in the laboratories. In the academic year 2006-07, the Laboratory of Sensors and Signal Conditioning of the Electronic Technology Department of the University of Vigo started using those sensors experimentally. During 2007-08 and 2008-09, a methodology based on these didactic sensors, combined with signal conditioning circuits and simulations in Pspice, has been launched. Then, a signal conditioning circuit is assembled and the information displayed on a PC monitor, connected by a data acquisition system. Furthermore, this paper includes the efficiency evaluation results of the proposed methodology, obtained from student surveys.

Keywords—capacitance transducers; circuit simulation; learning systems; level measurement.

SUMMARY

The instrumentation and measurement topics in the engineering education present big difficulties in the followed methodology, the economic cost of the materials and equipments, and in the time spent in the laboratory for practical classes. In this work a way to obtain didactic capacitive sensors [1], which show the physical measuring principle and being easy to hand by the students at a low cost, is presented. Several capacitive sensors to measure liquid level, water and oil, have been developed by using recycled and common materials, which are familiar for the students (Fig. 1). The flat capacitor is made of a CD box with two aluminum laminated papers attached to each side of the box. The cylindrical one is made of concentric copper pieces of common pipes.

The simplicity of these sensors has allowed students to see physically the primary measuring element and to prove how they work. Moreover, as they are built with simple elements, they have contributed to be demystified, because sensors frequently appear as a “black box”.

In the practical classes involved with these sensors, it is important to highlight the useful experiences carried out to study important topics in learning sensors as: the repeatability,

sensitivity, dead band, saturation and the most important, the uncertainty [2]. As well as the circuits to condition capacitive sensors, whose most important aspect is the fact that students include the physical variable (in this case the level of a liquid), the sensor (or transducer) and the conditioning circuit in a global electrical simulation by PSpice [3], modeling and simulating a complete measuring system, before prototyping the real system connecting it to the real sensor and to the PC (personal computer) including a DAS (data acquisition system) [4].

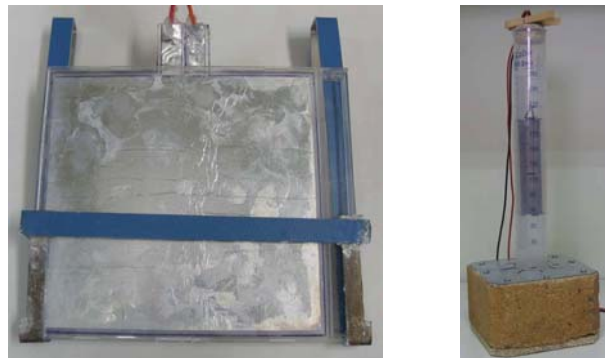


Figure 1. Sample photographs of the developed sensors (flat and cilindric).

This way to study this kind of sensors has been validated in the final year of studies for the Telecommunication Engineering degree at Vigo University, and it is part of a course on sensors and conditioning circuits, comprising 60 hours of practical classes in an electronics laboratory. The main objective of this course is to provide students with the capability to design a complete measurement system and, at the same time, by following the European Higher Education Area (EHEA) methodology.

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Development of a Wiimote-based gesture recognizer in a microprocessor laboratory course

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Abstract— This gesture recognizer, developed by students in a third-year microprocessor-based laboratory course, takes Wii remote (Wiimote [1]) as an input device to estimate the movements of the user and to compare the detected trajectory with the previously learnt movements, in order to carry out the associated actions. Such a cheap state-of-the-art wireless user interface is very attractive for the students and can be used in many interactive applications, from robotics to virtual reality and multimedia presentations. By combining commercially-available hardware, pattern-matching techniques and programming skills, we are able to foster students' interest on developing innovative potentially-marketable systems. This freeware project, implemented as a configurable publicly-available library, can be adapted to the needs of any course or Finite state automaton of the gesture recognition system. In our laboratory this open-source DLL is used for remotely controlling a robot (based on an open-hardware Arduino platform [2]), using a PC and the Wiimote, although the DLL can be integrated in any C, C++, Java or C# project. A GUI application (based on a Model-View-Presenter paradigm) is also provided and can be used as a template for new applications or just for debugging purposes. Although the developed application only uses data from the accelerometers, data from the infrared camera and buttons of the Wiimote is also available.

Microprocessor; Wiimote; Project Based Learning; open source library; microprocessor programming; Arduino¹

SUMMARY

A new engaging project has been proposed, designed, implemented and tested for a PBL course on microprocessors. The use of cheap wireless game-oriented commercial hardware, open-source software and hardware and pattern-matching techniques is very attractive and has already engaged several teams of students during the last two years in a third-year microprocessor-based laboratory course. This freeware project is able to foster students' interest on developing innovative potentially-marketable systems.

The gesture recognizer estimates the movements of the user's Wiimote (Figure 1) and by comparing the detected trajectory with the previously learnt movements, is able to carry out the associated actions in interactive applications (from robotics to virtual reality and multimedia presentations). Implemented as a configurable publicly-available library, it can

This work was supported in part by UPM under innovation projects

be adapted to the needs of any course or student. In LSED laboratory at UPM, this open-source DLL is used for remotely-controlling a robot using a PC and a Wiimote. The developed DLL can be integrated in any C, C++, Java or C# project and a GUI application is also provided as a template for new applications or just for debugging purposes. Although the developed application only takes data from the accelerometers, data from the infrared camera and the Wiimote buttons is also available.

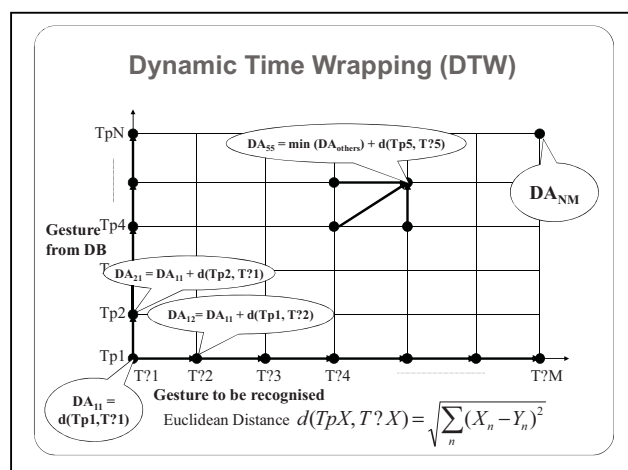


Figure 1. Graphical description of Dynamic Time Wrapping

After this second-year experience, next year we can offer a standardized project to most of the students in the LSED laboratory course. There is a video demonstration at <http://www.youtube.com/watch?v=joo3G3BejwY>

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Hands-on intelligent mobile robot laboratory with support from the industry

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Abstract—The widespread use of robots in many areas makes the fundamental understanding of them a necessity for many electronic system design engineers. Therefore, to effectively speed up the learning process, the applications of learning-by-doing hands-on laboratory to help students get acquainted with the design and implementation of robots is inevitable. Lunghwa University has teamed up with local microcontroller manufacturers to redesign course contents, to host free workshops supported by the Ministry of Education, and to hold national contests for intelligent mobile robots. The devised low cost educational robot kits and multimedia lecture notes not only reinforce the hands-on laboratory exercises, but also help motivate students to learn actively the intelligent mobile robots.

Keywords- mobile robots, hands-on laboratory

SUMMARY

Robots are mechatronic engineering products, capable of acting autonomously in various physical environments. The widespread use of robots in many areas makes the fundamental understanding of them a necessity for many electronic system design engineers. Unfortunately, learning the design philosophy of robots is interesting but difficult, because it includes many areas of knowledge. Teaching the autonomous mobile robot design course is a challenging undertaking because one can not assume that all students enrolled in the class have solid prerequisite knowledge in so many areas. It is noted by Heer *et al* [1] that introducing a platform for learning™ robotics courses enhances students' sense of community, innovation capabilities, and troubleshooting skills. The students could experience first-hand the fun associated with robots while gaining a sense of accomplishment. Therefore, to effectively inspire students' interest and motivate them to participate actively in the learning process, the application of hands-on laboratory which leads to an interesting robot to help students learn the design and implementation skills of robots is inevitable.

Heer *et al* [1] propose a low cost and easy to control Tekbots platform for hands-on freshman and even senior level robotic exercises. The Tekbots platform is simple and good for motivating the students, but it may not be used to experience more advanced firmware implementations, control, signal processing, and path planning algorithms. Kuc *et al* [2] used Javascript simulations to make students familiar with what robots can do to interact with environments. The students can develop their own logic circuit designs to program a robot for tasks of increasing complexity. Once the designs are verified

in simulations, they can be downloaded to the robot and control the robot in an actual environment. Although students can check quickly whether their ideas work or not for tasks, this approach limits what students can learn in the hands-on exercises because the robot brain is a combinational logic circuit. To make the learning platform more fun and versatile, Lunghwa University of Science and Technology has teamed up with local microcontroller companies (see figure 1) to design low cost line following robots and micromouse, and the corresponding multimedia lecture notes. These companies support not only free samples of microcontrollers, integrated design environments (IDEs), but also free workshops and technical support in this project. By using a similar idea to that described by Hussmann *et al* [3] to inspire students' interest furthermore, the team also works together to hold contests for these mobile robots. The contests and free workshops for university and vocational high school students are also supported by the Ministry of Education.

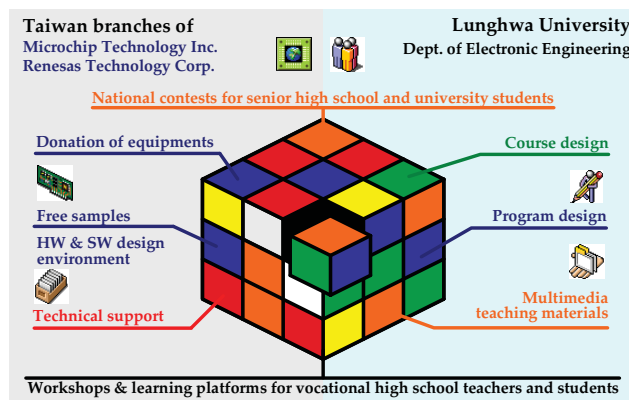


Fig. 1 The joint effort between Lunghwa University of Science and Technology and microcontroller manufacturers

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Cybertech: Robotic Competition and Subject

Learning Mechatronics from a practical point of view

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Abstract—This paper describes a subject and contest held in Universidad Politécnica de Madrid. This contest offers the students the opportunity of developing one or more robots so they can put into practice all their knowledge on electronic and mechanical systems. As a subject, all the students can attend a course in which they learn the basics on mobile robots. As a contest, it encourages all participants to improve their designs so they can win important prizes.

Cybertech; robot; contest; subject; bull; fighting

I. INTRODUCTION

Robotic Competitions for undergraduate students are very popular nowadays. It has been demonstrated that this is a good method to involve the students in working teams and a way of teaching how real components work.

There are different contests all around the world where students develop different kind of robots for educational purposes, like Fire-Fighting, Robocup Junior or Hispabot. Other competitions are focused on reinforcing the research efforts on different areas, like RoboCup Soccer Competition and RoboCup Rescue.

All these competitions have something in common, the participants must show a working robot which can perform the task and they compete with the others to demonstrate that their prototype is the best. This makes the participants try to do their best and consequently the results are better.

The Universidad Politécnica de Madrid has several engineering competitions, one of them is Cybertech. The Cybertech competition started on 2001 with only 96 students and has increased this amount until 2008 with 140 students. Cybertech is yearly held at Industrial Engineer Faculty. Any UPM student can participate in the contest and attend the subject, no matter what faculty he/she is studying at.

Cybertech is a contest and subject made for and by students. It is coordinated by one professor at the Industrial Engineer Faculty and organized by last year undergraduate students and postgraduate students.

The students are grouped into teams of four or five people to design and build one or various robots. They can decide what event they are going to take part. Participants also have to prepare an oral presentation of their projects.

There are several challenges in Cybertech: Line-Followers, Maze, Bull-Fighting, Solar Racers and RoboSim. These challenges are widely explained in section 2.

The competition usually takes places around April. Section 3 shows how the contest is organized.

The contest is also an elective subject for the UPM students. This subject represents six free election ECTS credits. The subject is related on section 4.

On section 5, there is a description of the material given and recommended to the participants. Teams with students registered in the subject are given the Arduino microcontroller so they can follow the coursework.

Section 6 shows the amount of participants in each Cybertech edition and the influence of different milestones in the number of students.

Last section explains some improvements for the upcoming years in the contest and subject.



Figure 1. Bull Fighting.

Session: 03B Area 2: E-Assessment

A new competency-based e-assessment data model

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On Education Quality Control Issues for Sino-France Hybrid Engineer Diploma

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Assessment of learning activities in discussion forums online

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SOA-based Architecture for a Generic and Flexible E-assessment System

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A new competency-based e-assessment data model

Implementing the AEEA proposal

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Abstract. There are two unsolved problems in the field of virtual learning environments: a set of new types of assessment is required for learning management systems (LMSs), and there is a need for a way to assess lifelong adaptive competencies. Proposed solutions to these problems need to preserve the interoperability, reusability, efficiency and abstract modeling already present in LMSs. This paper introduces a competency assessment data model (CADM) being developed as part of adaptive evaluation engine architecture (AEEA). AEEA is designed to solve the above-mentioned problems while fulfilling all quality requirements. The CADM is described with a data centric model using XML for each assessment scenario.

Keywords: *Competencies, Adaptive Assessment; Competency Assessment Process; New Assessment Types; Virtual Learning Environment.*

SUMMARY

IMS question and test interoperability (IMS-QTI) [1] is an open technical e-learning specification to support the interoperability of systems and the reusability of assessment resources. Items and testing can be expressed and interchanged using IMS-QTI assessment. IMS learning design (IMS-LD) [2] is a specification for a meta-language which enables the modeling of learning processes, and is designed to express many different pedagogies. The activities to develop in a learning design can be expressed with IMS-LD.

In order to support new types of assessment in an e-learning process while preserving interoperability, reusability, efficiency and abstract modeling, new models to extend the current e-assessment specifications are required. In [3] and [4] a UML model is proposed to extend and combine IMS-QTI and IMS-LD specifications. [5] - [8] show how an outcome variable of a QTI test can be coupled to an IMS-LD property, and how assessment application tools can be integrated with IMS-LD as services. [9] and [10] propose the creation of a new layer over IMS-QTI and IMS-LD data, thereby establishing a new specification by building a high-level assessment process modeling meta-language. The LAMS project [11] is another kind of proposal based on IMS-LD and IMS-QTI specifications, but a totally new specification is being built to support a whole range of possibilities in e-assessment.

The development of lifelong competencies is a global tendency that uses the e-learning process to eliminate space and

time barriers. This is the background against which new pedagogical models supported by new assessment process models are needed.

These two ideas were taken into account in [12] when adaptive evaluation engine architecture (AEEA) was proposed. AEEA is a competency-based adaptive assessment process for to judge the competencies of learners in a virtual learning environment. The process is supported by extensions for educational specifications and for integral user modeling. In order to implement AEEA, four data models must be integrated: a competency data model [13] and [14], a user model [15] [16] [17] [18], a competency assessment learning design model [19], and a competency assessment data model (CADM). The design of a CADM, which includes the entire data model for e-assessment scenarios proposed in AEEA (formative peer assessment, formative teacher assessment, self assessment and summative assessment), is presented in this paper. It is described with a data centric model using XML for each assessment scenario.

The assessment items metadata and the test metadata are based primordially on the IMS-QTI specification and complemented with XML data on the appraised competencies.

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On Education Quality Control Issues for Sino-France Hybrid Engineer Diploma

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Abstract- Quality control in higher education is a complex social key project fostered by the Chinese government. As a sino-foreign cooperation school in engineering, we are focusing more intensively on quality control in higher engineering education. Sino-European School of Technology of Shanghai University (UTSEUS) was established by Shanghai University in cooperation with University of Technology Network (France) in 2006. Dual-campus education program has been introduced to UTSEUS ever since: two years of campus life in China, and the next two years in France. Challenges on the program designs, the teaching modes, the teaching strategies, teaching quality control and teaching collaboration have been updated accordingly concerning the different educational systems we have in China and that in France. With monitoring the dual-campus engineering education, several approaches have been introduced to the quality control of higher engineering education in UTSEUS.

Keywords- quality control, Sino-European cooperation, dual-campus teaching, teaching assessment system

In 2006, UTSEUS was officially established by Shanghai University (SHU) with University of Technology Network (UT) of France—University of Technology at Compiegne, at Troyes and at Belfort (UTC, UTT and UTBM). Through the study of the model and experience employed by the UT groups, the practice on teaching modes, teaching strategies, teaching quality control and teaching collaboration in dual-campus engineering education system utilized by UTSEUS has been implemented. This paper is to discuss how to manage the quality control in higher engineering education and what UTSEUS has accomplished so far in this field.

Total Quality Management (TQM) is the most intensive means in quality control. We have introduced several methods of TQM in our quality control of teaching quality. According to the essence of every TQM approach, we can find the corresponding approaches in quality control at different stages of the quantitative management in education, which includes control of pre-teaching design, teaching process control, and teaching quality assessment.

During the stage of pre-teaching design, we have tried the two-year reform in teaching program of mechanics. Our students not only have more access to practical training, but also refresh their understanding with the major. The criterion of education quality control is confirmed by our school and our students.

With the dual-campus system, the students in UTSEUS first spend three to four years studying in China, and then, they can

choose to study another two years and a half in France in order to attain the engineering diploma or two more years to gain a master degree there instead. We focus on the approaches of motivating both teachers and students during the teaching process quality control in dual-campus. The teachers design an efficient method to organize the course.

Considering our mode of dual-campus teaching system, we evaluate the quality of teaching by two methods: evaluation of students and evaluation of curricula. By using both absolute score and ECTS, we adopt an all-round evaluation model to evaluate the students' academic situation.

A teaching assessment system is under development to improve the efficiency of education quality management. The analysis and statistic of students' achievements is an important reference to quality control. Visual reports on teaching result and students' development trend are presented by an information system. Meanwhile, the course evaluations by students also do the job. The computer analyzes the submitted evaluation data and generates evaluation reports to summarize the teaching results which will be references for improvement. An auto generated box plot diagrams is a box and two line segments graphics indicated by five eigenvectors which include maximum, minimum, median and two quartiles. The box part of the diagram shows the distribution of the middle half ranked score. Box plot graph characterizes the distribution of test results.

To analyze the relationship of studying in China and in France, Pearson correlation coefficient is introduced. For the score data are continuous and approximately normally distributed, fit the condition of Pearson coefficient. The result is the Pearson coefficient is around 0.4–0.5. The significance is 0.01 that means the result is acceptable.

A Moodle site is set to provide e-learning services in UTSEUS. The Moodle system is open source software based on PHP. The low layer libraries of Moodle are well developed, it includes classes and functions covered database abstract and User managements. The base codes can be reused in new software development. The applications integrated in Moodle seamlessly with the benefits of mature user authorities and privileges mechanisms. By modify some core codes of Moodle; it fit the education quality control of UTSEUS well.

Assessment of learning activities in discussion forums online

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Abstract. - This is a report intended to describe a research about assessment of learning activities done in a virtual forum. Student's messages in the forum as a whole were considered as analysis unit. It was employed a content analysis technique to identify characteristics involved in the messages. Categories and indicators for analysis were defined from the Community of Inquire Model, adapted specifically for mathematics courses. Examples selected as a guide for learning activities assessment are shown, in terms of number and type of participation, as well as result from linear correlation analysis between numbers of participations to each category.

Keywords.- Inquiry community, social, didactic and cognitive categories.

SUMMARY

Interaction in virtual forums has been studied by several researchers. For this study, Community of Inquire Model developed by Anderson, Garrison and Rourke [1, 2] were used to analyze interactions and learning processes in virtual forums, which is consistent with the constructivist proposal for learning. For this model it is supposed that the learning process is integrated by three central components: Social, didactic and cognitive dimensions.

It was perceived the need for original indicators to categorize the messages put into the forum, because there were several cases not included in the scope of the definitions made by those authors. Considering this new scale, indicators were redefined, in a way that the new set of indicators was suitable for two consecutive categorizations that produced same results. For each indicator, significant samples of text were collected.

The content of each message submitted to the forum was analyzed according to the previously defined indicators. When there were found one or more indicators, then it were considered that the message contained a collaboration of the type of the indicator and so it was counted. A message might include only one category indicators or two or three categories simultaneously. An important part of the study was adapting the Community of Inquire Model to the specific characteristics of the selected course. At the virtual forum participated eight

students and a teacher, all of whom submitted 321 messages; when using Content Analysis with defined categories and indicators.

The number of collaborations of each category is different. The number of collaborations of social category (S) and didactic (D) are similar (252 and 269 respectively), while the cognitive category (C) just had 96 contributions. This distribution seems reasonable for it corresponds to collaborations submitted to virtual forums where students and tutors direct their learning process through debating course contents [1]. It was observed that the amount of participations corresponding to each category was different for each learning activity, this suggests a variation for each category along the development of the course.

From results it can be said that using this model was useful for studying the development of learning activities in the virtual forums. It could be convenient for designing future courses in similar contexts. Data collected employing indicators defined for this research can be useful as an assessment instrument for student performance in the forum, besides, they are useful to assess the effect of learning activities designed to impulse knowledge building (cognitive category). Frequency measurement of collaborations to each category was used to find and understand collaboration patterns, however this is not a quantitative research purposed for statistical inferences. But it was a first approach to understand and explain the complex development of online learning activities. From this perspective goals were accomplished.

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SOA-based Architecture for a Generic and Flexible E-assessment System

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Abstract— In the last decade, universities and higher education institutes have become more and more interested in using computers to deliver their formative and summative assessments. Therefore, several computer-assisted-assessment systems have been developed. The variance in the application domains of e-assessment has a main influence on having different assessment systems in the same university. Since universities have different colleges and specializations based on their types and in order to deliver their assessment activities online, each college is developing or buying assessment system or tools based on its specializations and courses. This caused some universities to have more than one computer-assisted-assessment system. In this paper, a service-oriented e-assessment system will be suggested to solve this problem. A service-oriented architecture for a generic and flexible assessment system will be provided with cross-domain use cases to show the flexibility of this architecture.

Keywords—component; E-assessment, Modular assessment system, Assessment services, Service-oriented architecture for assessment, Middleware for tools interoperability.

SUMMARY

The breadth of the assessment field and its richness of several application domains raise problems when it comes to develop tools to assess such application domains. Numerous commercial and academic assessment systems and tools are available, assessing several application domains. The level of coordination between those systems and tools highly depends on the standards and specifications underpin them as well as the domain related activities. In e-assessment design and development, the new developed tools should have the ability to communicate and interact with the existing ones without further modifications. Such tools should not be tightly coupled to a specific assessment system. Rather than, they should be reusable and interoperable so that they can be used to extend other systems and tools in different faculties and institutions.

In the world of Service-oriented Architectures (SOA), the new developed services hold great promise when they are interoperable and fit with existing tools' services. One promising area is to modularize e-assessment systems in a way of composing loosely coupled assessment tools together. Such

composition requires: i) clear guidance represented by a well-formed *framework*; ii) *standards and specifications* that represents the whole process of assessment as well as the communication between the services and components; iii) *cross-domain requirements analysis* in order to define the specific requirements for each application domain (such as, educational editor in the mathematic domain); iv) *web services* that provide the cross-domain requirements and interact through well-defined interfaces.

A Modular Assessment system for Modern Learning Settings (MASS) has been suggested as a generic and flexible e-assessment system. For the sake of flexibility and generality a SOA-based architecture for MASS has been designed. The design of this architecture is done with the guidance of the SOFA framework for assessment [1]. The SOA-based architecture has been mapped into a more detailed architecture with a clear view of MASS components and modules. The detailed architecture has four main layers of: User Agents Layer, Application Layer, Middleware Layer, and Application Domains Layer.

MASS highly depends on interoperable web services that can extend MASS's assessment native services (Authoring, Scheduling, Delivering, Scoring, and Reporting) to assess specialized kinds of assessment (e.g. Algebra assessment and Programming assessment) based on several application domains. A Middleware layer has been located between the Application Layer and the Application Domains one. This Middleware will be designed to handle the use of domain-based web services to extend MASS's ones for specialized application domains. Moreover, it will be used to facilitate and tackle the problems and challenges of running external domain-based tools within the context of MASS.

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**Session: 03C Area 4: Rethinking Pedagogy in Engineering Education -
Multidisciplinary issues**

Impact of Learning Experiences Using LEGO Mindstorms® in Engineering Courses

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Competencies for Informatics Systems and Modeling. Results of Qualitative Content Analysis of Expert Interviews

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Introducing multidisciplinary thinking in Computer Engineering - A new way of teaching database systems

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Engineers and their practice: a case-study.

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Impact of Learning Experiences Using LEGO Mindstorms® in Engineering Courses

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Abstract— This paper describes an experience using LEGO Mindstorms® in three different university courses in the last five years. The focus in those experiments is to show how a mixture of collaboration, competition and peer learning in a laboratory environment helps the students to increase their motivation and improve their professional skills such as problem solving, team work and leadership. The paper includes statistical information collected during the experience, and lesson learnt about how informal learning takes place in these contexts.

Keywords: *Active learning; LEGO Mindstorms®; learning experiences, engineering courses, evaluation; assessment; surveys; empirical results; Java programming.*

SUMMARY

It is well known by the educational community that active learning has a greater impact on the effectiveness of the learning process than other methods. Active learning is even more required in technical studies (such as engineering), in which obviously concepts and topics studied in class must be put into practice in different scenarios so that the students fully understand the fundamentals and also acquire the necessary competencies to apply them to solve real-world problems. Actual markets demand that professionals are mastered not only in a specific knowledge domain, but also in professional skills, such as leadership, team work, autonomous and collaborative learning and management of increasing amount of information in short periods of time. To cope with these demands, the European Higher Education Area (EHEA) is investing a huge effort to foster the conversion of former ways of teaching into a new paradigm: student-focused, holistic and comprehensive, helpful and encouraging, promoting autonomy and proactiveness, able to increase the student's motivation and disposition towards the course and thus improving the outcomes of the learning process. Apart from the competences specific to their curriculum, the integral vision of the learning experience is assumed to produce better qualified professionals.

Going a step further, most effective learning techniques involve direct, purposeful learning experiences, such as hands-on or field experiences. In particular, computer-controlled models have been a useful aid in teaching programming, Artificial Intelligence and Robotic concepts. With this objective in mind, LEGO Mindstorms® have been widely used in different contexts with different objectives and have proved to be a good vehicle for implementing these concepts. The

main reason, apart from the low cost of the hardware, is that, in general, the programming environment is simple enough to be easily learnt by the students. Thus, they can construct robots that perform complex tasks in a very short time. This combination of versatility and simplicity, together with its motivating potential, makes LEGO Mindstorms® a powerful help in a variety of learning scenarios.

In this paper, we describe the experiences using LEGO Mindstorms® that have been carried out in three different contexts in the last five years: an elementary course on Programming, an advanced-level course on Artificial Intelligence and a third first-level course on Robotics. These experiences started in 2005 and obviously involve a variety of different scenarios, students groups and course levels. The focus in our study is not on discussing whether using LEGO kits proves better than other methods to teach/learn technical topics, but rather on describing how this mixture of collaboration, competition and peer learning in a laboratory environment helps the students to increase their motivation and improve their professional skills such as problem solving, team work and leadership.

The originality of our study in relation to previous work is the length of the experience, the fact that it has been performed simultaneously in different contexts and our focus on analyzing the way in which informal learning takes place in these competitive and collaborative environments. In our paper, a critical analysis of how the methodology affects the learning experience is done considering both subjective and objective results. We also provide a description of the challenges, technical issues, parameters and references to implement this experience using LEGO. In addition, we provide the workflow description and list some lessons learnt about informal learning in order to enrich other learning environments not directly related with LEGO Robots.

We show the impact in student motivation, providing measures about the benefits of competitive, collaborative and peer learning as they are perceived by the students. Based on with the data collected during these experiences, we also calibrate some issues like the optimum group size, session length and number of challenges. We expect that the information provided by our experience can be useful to other groups interested in using LEGO Mindstorms® to promote active learning in their classes and maximize the success of their experiences.

Competencies for Informatics Systems and Modeling

First Results of Qualitative Content Analysis of Expert Interviews

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Abstract— The article presents the first results of expert interviews conducted within this project funded by the German Research Foundation (DFG). These are intended to refine our first theoretically derived competence model comprising competencies in the domains of informatics systems and modeling, which allows us improving software engineering education. It will be shown which competence aspects have been added to the theoretical model and how to advance in an empirical manner.

General Issues in Engineering Education, Pedagogies, Modeling Competencies, System Comprehension, Active Learning

SUMMARY

This article describes the methodical strategy to develop a competence model for informatics systems and modeling especially conducting an analyzing expert interviews within the project “Measurement Procedure for Informatics in Secondary Education” [1]. In a first step a theoretically derived competence model was developed – which is described in the article. In a second empirical step of competence modeling expert interviews were conducted. This accompanying empirical procedure was undertaken in order to supplement and refine the theoretical model. The expert interviews were transcribed in full and analyzed by means of qualitative content analysis. 30 experts on informatics were interviewed, whereas the sample configuration was chosen with regard to the widest possible range of informatics and informatics education expertise. Due to these results of the qualitative content analysis refinements on the theoretically derived model were accomplished. The article gives an outline of an exemplary analysis of 17 interview transcripts. The main objective of qualitative content analysis is to reduce the large text material to a manageable size in such a manner that important information is not wasted.

In the article we analyze experts’ answers on two different kinds of scenarios, i.e., testing unknown software to understand an informatics system and the development of a merchandise management system with a focus on informatics modeling. The application of the empirical method Critical Incident Technique followed by a content analysis procedure established new competence components. As highlights of this article we summarize two research results, which will influence our further work in a specific way. According to the experts, two competencies are necessary to cope with scenarios on testing of un-

known informatics systems and informatics modeling. These are *Scalability* and *Change of view*.

Scalability was found through the different research perspectives, in informatics systems and informatics modeling. One important conclusion is the criterion scalability can be used to decide, which solution should be applied to different problem sets. Another important conclusion is that the context specific selection of modeling techniques represents the application of scalable informatics problem solving strategies. For the reader it is obvious that the person who is faced with an informatics system plays different roles, firstly as an explorer of informatics systems, secondly as a developer of such systems. It would be possible to describe both phenomena with different expressions to distinguish these aspects of scalability. But we decided to combine the two conclusions in one more abstract competence component *Scalability*, because both aspects constitute the appropriate problem solving strategy.

A criterion for the success of problem solving is the selection of the most appropriate informatics strategy related to theoretical foundations and practical tools. Denning defines views as “The five windows of computing mechanics” [2, p 17]. Therefore, a change is recommended between different solution strategies of problem solving. Several experts stress the meaning of this relation. Informatics should not be reduced to programming. Therefore, we assume that this competence dimension is incomplete if only a static sequence of *External view* and *Internal view* with their facets is considered and we insert a new component, *Change of views*.

The described results suggest that refinements and supplements will be successful. Additionally it is necessary to prove the resulting competence model in further empirical research steps focusing on the content and criteria validity of the model. In a next step informatics experts with different backgrounds of expertise shall evaluate the relevance, difficulty, representativeness and differentiation of the determined competencies to prove the content validity of the refined model.

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Introducing multidisciplinary thinking in Computer Engineering: A new way of teaching database systems

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Computer Engineering courses are seeing a drop in enrollments in several countries, as reported for instance in the CRA (www.cra.org) statistics in the USA. Given the great need for qualified manpower in this area, many universities all over the world are updating their curricula, or introducing new course modalities, to attract a wider spectrum of candidates. As part of the same trend, traditional subjects are being restructured, to show students how they can be apply what they learn to new fields.

This paper describes an experiment conducted in Brazil in teaching database systems to undergraduate CE and CS students at the University of Campinas (UNICAMP), one of the country's top universities, with the oldest Computing course in the country (started in 1969).

This experiment was based in introducing a new way of looking at databases, and showing the students how they could combine such technology with other subjects, thereby allowing them to manage new kinds of data and solve problems in other sciences. Course material was reorganized in two stages: in the first stage, students were taught how database systems are needed (and profit from) other subjects, such as VLSI design, compiler construction and software engineering. In the second stage, students had to work with the RASDAMAN (www.rasdaman.com) raster database system, which is geared towards managing multidimensional data. Basic database material was revisited during this stage, showing how it could be used to solve problems in multidimensional data handling - e.g., in environmental control, image analysis in health studies and in biodiversity.

Engineers and their practice: a case study.

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Abstract— There has been a growing awareness of the need for models of engineering practice in recent years and the publication of *The New Production of Knowledge* by Gibbons [1] led to considerable attention being focused on two distinct modes of knowledge production: Mode 1 associated with a traditional academic discipline-based approach and the more recently-emerged Mode 2 a problem-focused process more common in the entrepreneurial sphere. The case-study reported originally set out to use Gibbons' models to characterize the work of a group of Portuguese engineering researchers over a 15-year period. The study employed a qualitative methodology and narrative approach to characterize practice within this group of engineers so as to look for appropriate lessons that can be applied to engineering education to better prepare future professionals.

Analysis of the information gathered during the study of the YDreams company has caused us to question our original model of engineering practice and leads us to the conclusion that the Unifying Model recently proposed by Trevelyan [2] could represent a better fit to characterize the activities of this group and would suggest a need to gather empirical data on engineering practice in the European context.

Keywords: *Model, engineering practice, knowledge production, case study*

SUMMARY

The data presented suggest that, although the Gibbons' Mode 1 and 2 characterizations can be seen as useful to characterize in a broad sense the knowledge production activity of the group of engineers in question, they should not be seen as an either/or way of describing the real-world activity involved.

Noting that a significant number of engineers in the YDreams company in our study were in posts of responsibility outside conventional engineering domains and that the CEO identifies communication skills as a priority for success, has lead us to see limitations in our original model of engineering practice which was based around engineering design and knowledge production and encouraged us to look for alternatives, particularly for models based on an empirical approach. Although the vast majority of literature

on engineering practice tends to view it in terms of design or technical problem-solving such models are rarely based on empirical studies analyzing what engineers do.

A model proposed in 2009 by James Trevelyan of the University of Western Australia does however address these issues. The Unifying Model of Engineering Practice sees engineering as social system involving a sequence of steps common to most engineering activities and which are enclosed within a scaffold that continually guides the implementation steps towards the intended objectives. The scaffold in turn involves continual interaction between all the participants, including the client, financiers, engineers, contractors, suppliers, production and service delivery workers and others,. This model grew from a longitudinal study of engineering graduates in Australia which showed that the majority spent less than 30% of their working time on specialized problem-solving and that nearly 60% of their time is spent interacting with other people, including working face to face, meetings, correspondence and reports. This finding would tend to give weight to the comment of the CEO in our study on the importance of communication skills. Accordingly it is important to have empirical data on the activity of engineers in successful companies so as to achieve a good alignment between engineering education and the needs of future engineers and their employers.

Our current research, carried out in collaboration with the University of Western Australia, involves empirical data collection from engineers in YDreams and other firms considered innovative in the Portuguese context to see to what extent the Australian data and the Unifying Model are relevant to the southern European context and how this model can help adapt engineering education to the needs of tomorrow.

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Session: 03D Area 1: Computer and Web based Software - Physics Applications

An application-case for derivative learning: optimization in colour image filtering

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Educational Computer Tool for Visualizing and Understanding the Interaction of Electromagnetic Waves with Metamaterials

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Illustrating amazing effects of optics with the computer

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A simulation software for sequential control

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An application-case for derivative learning: optimization in colour image filtering

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Abstract—Related to the notion of derivative of a function, its application to function optimization is an interesting and illustrative problem for Engineering students. In the present work, we develop an application of the derivative concept to optimize the filtering of a colour image. This implies to optimize the value of the filter parameter to maximize performance. We propose to maximize the quality of the filtered image represented by the *Peak Signal to Noise Ratio* (PSNR), which is a function of the filter parameter. The optimal value for the parameter is obtained by means of an algorithm based on the approximation of the derivative of the PSNR function so that finally the optimum filtered image is obtained.

Keywords: derivative learning, optimization, image filtering

Educational Computer Simulations for Visualizing and Understanding the Interaction of Electromagnetic Waves with Metamaterials.

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Abstract— In contrast to ordinary materials, metamaterials show interesting properties that are not found in nature. These properties are counterintuitive and difficult to understand for the students. This work describes a series of virtual experiments that were carried out by means of an extension of the FDTD technique for modeling metamaterials. The result of the simulations was recorded and a collection of videos developed as a supplementary tool for teaching at advanced undergraduate and graduate levels. The objective is to help the student to understand the interaction of electromagnetic waves with these media by means of the visualization of the evolution in time of the physical phenomena.

Keywords— component; educational software, visualization, metamaterials

SUMMARY

In 1968 Veselago theoretically investigated a new kind of artificial media called “metamaterials” that present extraordinary electromagnetic properties not observed in nature. However, his pioneering work remained forgotten for almost 30 years, until the first possible realization of a metamaterial was presented. Since this first synthesis, metamaterials have been a subject of growing interest, not only for their exotic electrodynamics properties [1], such as the negative refractive index ($n < 0$), backward-wave propagation, negative Goos-Hänchen shift, reversal Doppler effect, inverse Cerenkov radiation,... but also for their important potential applications in the development of novel devices, perfect lenses, invisibility, etc.

In general, students have difficulty in perceiving the behavior of electromagnetic waves. The situation is worsened when metamaterials are involved, since they exhibit an electromagnetic response not found in natural media that seems counterintuitive to the students.

Electromagnetic simulators have proven to be useful teaching/learning tools to provide physical insight into the phenomena under study. In this work an extension of the finite-difference time-domain (FDTD) technique for modeling metamaterials has been used to carry out a series of virtual experiments. These experiments have been carefully chosen to illustrate the characteristic behavior of electromagnetic waves in these media. The result of the simulations has been recorded and a collection of videos has been created. These videos provide aid in the teaching of the exotic electromagnetic

properties of metamaterials, such as negative refraction, backward propagation, negative Goos-Hänchen shift, etc. By means of the visualization of the progression of the fields as they actually evolve in space and time the students will acquire a deeper physical insight into wave propagation in this kind of artificial materials. The videos are intended for advanced undergraduate and graduate students.

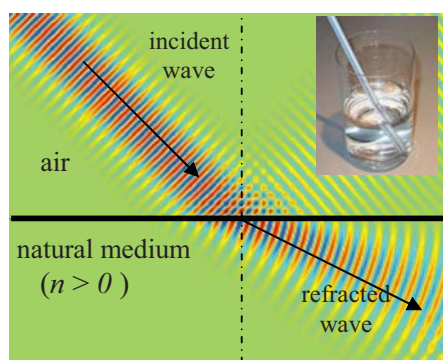


Figure 1. Positive refraction at the interface between air and an ordinary medium.

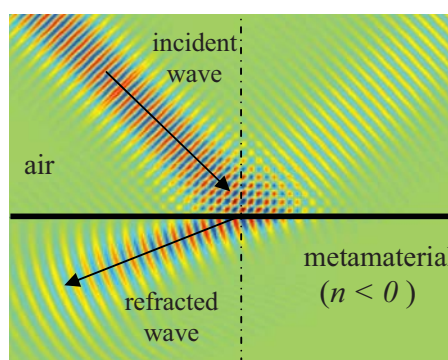


Figure 2. Negative refraction at the interface between air and a metamaterial: the light bends back from the normal.

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Illustrating amazing effects of optics with the computer

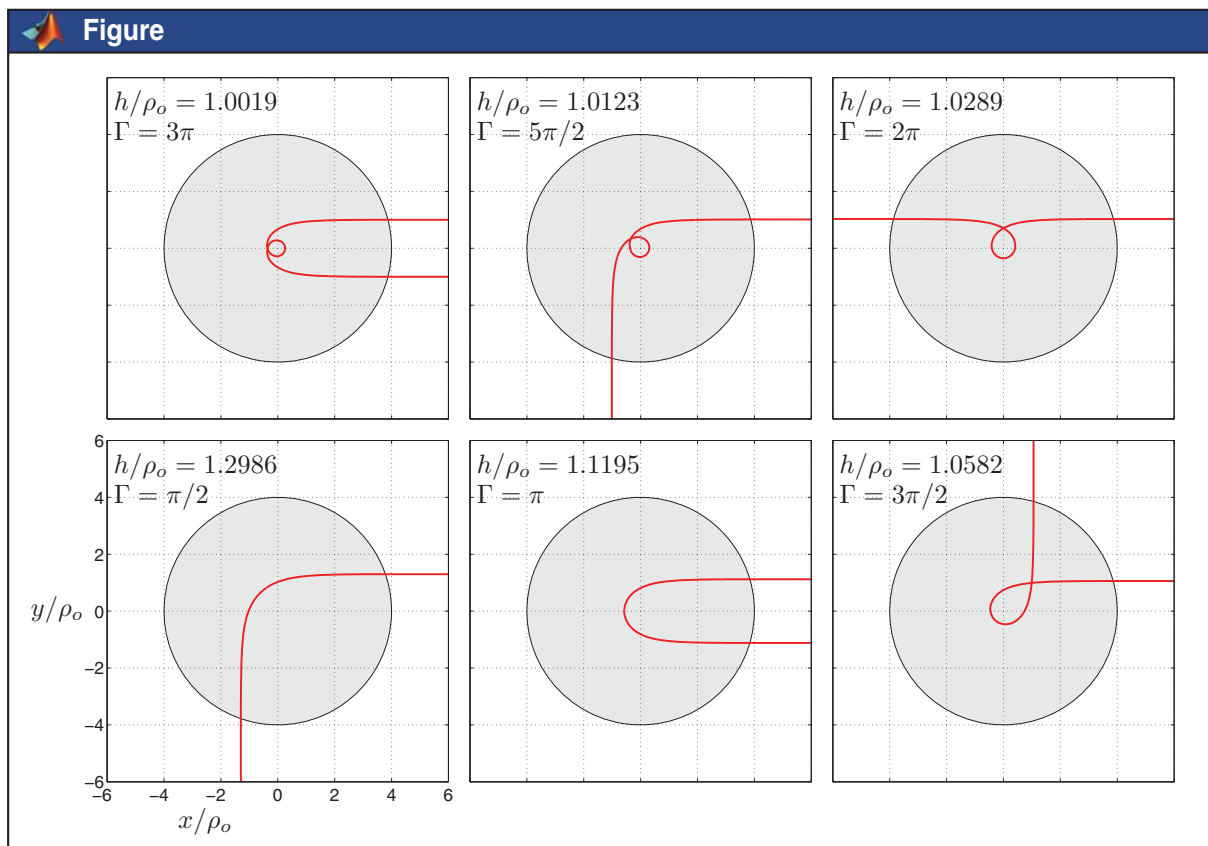
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The ray optics is the branch of optics in which all the wave effects are neglected: the light is considered as travelling along rays which can only change their direction by refraction or reflection. On one hand, when propagating in media with constant refractive index, the SNELL-DESCARTES laws can be applied for implementing a fast numerical ray-tracing procedure based on a geometrical approach of the problem. On the other hand, when propagating in media with non-homogeneous refractive index, the differential equation governing the propagation of light has to be solved with the aid of the computer. This contribution describes a fast, accurate and easy to use code for illustrating the propagation of light in such media with spatially varying refractive index, sometimes with amazing effects of modern physics that cannot be brought to the attention of students without the aid of

numerical simulations, or except at an expensive cost. It has been developed under MATLAB environment in the framework of an educational project, but it is general enough to be useful in most of the cases.

All the lines of code are given so that they can be freely distributed and re-used. According to the approach adopted by the authors, moving from one study to another just requires to change the lines of code written in one MATLAB function supplied by the user: this is exactly what is done in the classroom.

Shown in the figure below are some light trajectories (*red curves*) in a non-homogeneous media (*gray disk*) with a refractive index satisfying the law $n^2(\rho) = 1 + \rho_o^2/\rho^2$ for different values of the ratio h/ρ_o , h playing here the role of an impact parameter and the angle Γ that of a scattering angle.



A Simulation Software for Sequential Control

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Finite state machines are a fundamental issue in a big number of fields in industry, such as sequential control, digital electronics, automated systems, automated reasoning etc. In our experience at the Universidad Politécnica de Madrid (UPM) we have found that the traditional approach of teaching the fundamentals of finite state machines through formal models is neither motivating nor allows to transmit the basic underlying principles to the student in a simple way.

Bearing this in mind we have developed a simulation software prototype in C++ programming language which uses the powerful 3D graphical libraries OpenGL and the portable Window Manager (GLUT) to develop simple 3D systems for sequential control which can be visually attractive to the student.

Keywords: Finite state machines, simulation, sequential control, PLC, physical systems.

SUMMARY

Finite state machines are a fundamental issue in a big number of fields in industry, such as sequential control, digital electronics, automated systems, automated reasoning etc. In our experience at the Universidad Politécnica de Madrid (UPM) we have found that the traditional approach of teaching the fundamentals of finite state machines through formal models is neither motivating nor does it allow to communicate adequately to the student the basic underlying principles.

One approach to teach the basic underlying principles of finite state machines to the students at the beginning of the course is to employ simulation using as front-end SCADA (Supervisory Control and Data Acquisition) applications (as in [1]) together with a PLC simulation tool (as in [2]). This approach poses a number of problems. In the first place it becomes necessary to overcome the cost of software licenses which can be of several thousand of euros. In the second place, the level of abstraction is in many cases too close to the concrete system for an introductory course on finite state machines. Finally there is the drawback of using proprietary software as there are many practical examples in industry where finite state machines need to be implemented in a general purpose framework.

Motivated by the above facts we have developed a simulation software prototype in C++ language which uses the

powerful yet simple 3D graphical libraries OpenGL and the portable Window Manager (GLUT) to develop simple 3D systems which can be visually attractive for the student. At the moment we dispose of four basic physical environments (garage door, elevator, cylinders and production chain). Each system requires a sequential control which can be implemented by a finite state machine. In each case the student needs to program the control in a plain text file written in C which associates sensor information with the corresponding control actions. After compiling the text file, the student can then watch the effect on the system. Additionally appropriate software engineering decouples the logical and graphical parts of the application so that it is relatively easy to add new elements to the graphical library which can then be employed in some or all systems.

At the Universidad Politécnica de Madrid we teach a number of courses related to programming and finite state machines. We have employed our prototype for the first time this year in the early part of the course on Automated Systems both in theory (to illustrate the basic principles of sequential control) and in the laboratory (for physical system simulation). In the latter case we think that the prototype gives the students a better understanding of the system before they start programming the PLC. Inversely, we plan to use the tool in some of the SW courses (e.g. Industrial Informatics or Software fundamentals) to illustrate how to implement a finite state machine in a general purpose language.

The initial feedback of the students has convinced us of the effectiveness of our approach as the motivation of the students has become clearly visible. It is as yet too early in the year to correlate effort with understanding of finite state machines but there has clearly been an increase of hours of dedication as opposed to previous years. Additionally, personal opinions of some students have been very gratifying and encourage the authors to develop new 3D systems for future courses.

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Session: 03E Area 1: Wireless, Mobile and Ubiquitous Technologies for Learning

Development of a mobile learning framework for analog electronics course

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M2Learn: Towards a homogeneous vision of advanced mobile learning development

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Adaptive Ecology M-Learning for National Park Based on Scaffolding Theory

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Development of a Mobile Learning Framework for an Analog Electronics Course

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Abstract— With the growing popularity of mobile devices, several projects for mobile learning courses have been developed. Those equipments allow a superior portability and accessibility of the learning courses. In this context, the present paper focuses on the development of a mobile learning framework for an analog electronics course. This course was designed as a supplementary mean to the classic analog electronics courses. The course project consists of several interactive multimedia modules. At the end of each module, students have several oriented questions to answer. The set of answers, in SMS format, gives feedback to the teacher about the learning process. Another module, that is under development, is responsible for storing and managing the answers in a server, where all the results from students are processed in a competitive learning based methodology application.

Keywords- Mobile learning environment, mobile devices, analog electronics course, competitive learning

SUMMARY

Being important that students have always the possibility to acquire their knowledge through traditional ways, the combination between e-learning and the classroom ambient learning is a good solution for specific courses, if not for all. However, mobile learning (m-learning) is, at the present, more innovative and student centered, concerning in the use of mobile devices, like cell phones, Personal Digital Assistants (PDAs) and smart phones. M-learning can be defined as “the exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning” [1]. The real problem with the concept is still the quest for an efficient and suitable adaptation of the courses contents to means with clear restriction factors [2].

These days, the challenge for teachers is to prepare new courses based in a methodology that embraces the potential of the mobile devices and faces their restrictions. Innovative supporting frameworks should be implemented to accomplish that task. In an initial phase, these frameworks can be directed to specific courses, but they should be extended to accommodate more generic scenarios, being prepared to support almost any course.

With that in mind, a new m-learning framework for the analog electronics course was developed at Superior School of Technology of Setúbal (Polytechnic Institute of Setúbal). The

initial course material has been adapted to the m-learning environment and new contents were added, enriched with animations and interactive examples. Besides the traditional theoretical lessons, and laboratory practices, we propose the use of this m-learning system to reach a wider blended learning methodology, which also includes a Web-based module. As an example, Fig. 1 shows an animation where students can see the movement of the electrical charges inside of a NPN transistor.

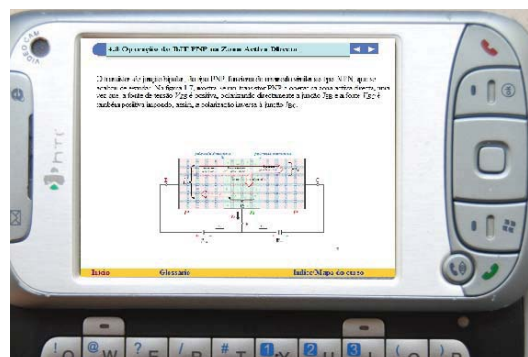


Fig. 1: Animated figure of a NPN transistor (with descriptions).

The current paper describes the course, which we consider innovative in the area of application, and the main points of the supporting computational framework development. The presented approach includes a competitive learning module, applied to the usual individualized and cooperative settings.

The paper is organized as follows. In Section II, we introduce essential mobile and competitive lines that support some taken options. Section III presents related work regarding analog electronics course and mobile learning projects, while the course features description is presented in Section IV. Section V is dedicated to the presentation of the developed MoCoL framework and to the technology solutions used for that. Finally, in Section VI, conclusions are made and future work is presented.

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M2Learn: Towards a homogeneous vision of advanced mobile learning development

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Abstract—This paper describes a middleware created as a need to interconnect the mobile learning environment with context aware systems and existing e-learning resources, simplifying the development of advanced mobile learning applications, based on the new mobile learning methodologies.

Keywords—middleware; mobile learning; service-oriented learning; ubiquitous learning.

ABSTRACT

This paper arises as a response to current research on mobile learning projects, which are geared mostly to implement the e-learning and traditional teaching methodologies on mobile devices. It means that many of the existing mobile learning applications are based on concepts such as study and assessment of digital material via mobile phones. Mobile devices are not the ideal technology to carry out these tasks due to the small size of its interface (display and keyboard). So it seems more appropriated to exploit the potential offered by these devices by changing the methodology and thinking in new scenarios. There, the new mobility features of these devices must offer a complement to traditional education, as in the case of:

- in-field learning (botanic garden, archaeology, etc.);
- learning on the move (transportation, etc.);
- informal learning (museums, aircraft, zoos, etc.);
- collaborative learning (review of performance in class voting, resolving queries, etc.).

The other focus of the paper is that most mobile learning applications have left behind what has been established during the last years as the main repository of learning resources: the e-learning platforms, e.g. Web-CT, dotLRN, Moodle or Sakai.

During recent years, much effort has been undertaken to develop e-learning platforms able to offer the services and resources that students need within the learning process. But most of new mobile applications leave them aside, creating ad-hoc, with little interoperability with other systems.

Finally, reviewing the technical literature related to mobile learning field, there are very few tools to facilitate the

development of mobile applications that comply with the new paradigm of mobility: integration of resources and services from e-learning platforms with context-aware systems and collaborative environments. This change would help students to take an active role in the learning process.

Therefore, authors have implemented a middleware devoted to simplify the development of mobile learning applications based on the following characteristics:

- Middleware that simplifies the integration of:
 - Context-aware systems
 - Location-based technologies (GPS, RFID, Wi-Fi, ...)
 - E-learning resources (digital content, chat, forums, on-line labs, evaluation, ...)
- Offering collaboration capabilities (synchronous and asynchronous communication; Web 2.0, ...)
- Open and flexible architecture with a service-based infrastructure (Through Web services and SOAP)

Through this development, educational organizations will achieve successful m-learning projects, because it encapsulates the inner complexity of the location techniques, learning services, context-awareness systems and management of e-learning resources.

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Adaptive Ecology M-learning for National Park Based on Scaffolding Theory

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Abstract—An adaptive ecology m-learning framework applied for national parks is proposed in this paper. This study proposes a framework based on Scaffolding Theory that provide learners mobile, dynamic and adaptive ecology guiding service to national parks. In addition, this study also adopt context awareness to provide the learner a suitable route planning for ecology guiding service according to environment factors such as weather condition, time and season, prediction of tide, UV rays and rain rate where learners located. Landscapes and ecology events such as Migratory birds in transit within the route can be actively delivered to learners immediately using interactive applications such as multimedia messages (e.g. text, image and video). Attention and enjoyment of learners can be increased and ecology education purpose of national parks can be achieved.

Keywords- Context-aware computing; m-learning; Scaffolding theory

SUMMARY

A “national park” is an area with a country’s special features or cultural or historic significance. By sustainable interpretation and the ecology tourism with profound experience and respect to nature, visitors can observe and learn from nature and then the sustainable management of national park can be achieved. Therefore, ecology education is an important function of national park management. Figuring out how to achieve the purpose of guiding service of national park through new technology assistant and then let more people enjoying, understanding and acting to improve, the natural environment, more often is the intention of this study.

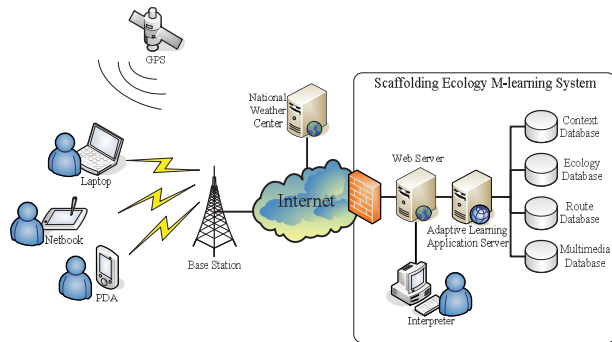


Figure 1 Framework

In this study, a framework of adaptive ecology m-learning for national park is proposed. This framework is also based on Scaffolding Theory to provide an adaptive m-learning for learners. In Figure 1, the learners can use laptop, netbook, PDA or any available devices which support wireless telecommunication technologies such as HSAP or WiMAX. Once the learners connect to internet, they can obtain adaptive content of ecology guiding information and interact with the interpreters via the scaffolding ecology m-learning system. The adaptive learning application server generates adaptive content according to the learner’s inherent properties and extrinsic environment factors.

In Figure 2, a content delivery process is proposed with the interactive mechanism.

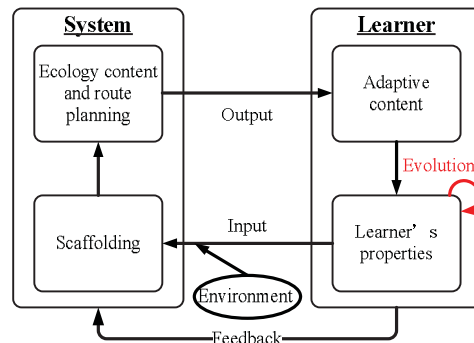


Figure 2 Content delivery process

CONCLUSION

In this study an approach is proposed to take scaffolding and context awareness into account for the area of ecology education and learning, and telecommunication technologies are used to connect between the learners, the interpreters and the scaffolding ecology m-learning system through internet. This framework has shown how adaptive functionalities can be embedded into mobile interpretation services for retrieving ecology resources and suitable ecology route plans to enjoy the benefits of ecology guiding service. The interactive messages between the learners and the interpreters through knowledge creation procedure can be preserved, shared and passed down. Eventually, the learners obtain ability of how to learn independently and how to share their precious experiences.

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Abstract—This paper introduces the concept of a Wi-Fi tag that can be used as an extension of the iLab remote laboratory framework. A Wi-Fi tag has been built by Tag4M of Austin, TX, USA, with the purpose of connecting sensors to the Internet where data is displayed using Web Pages that are posted and can be accessed from anywhere in the world. The Tag4M Wi-Fi tag is tiny and low cost works on battery power, and therefore it is very suitable for student experimentation as an extension of the remote laboratory framework. The tag allows remote students logged in the iLab framework to execute local or home based experiments, and by that brings more hands on capability to the framework. The paper introduces the Tag4M tag, the iLab framework, gives an example of using the iLab framework with the NI ELVIS station, and shows how this type of experimentation can be enriched using the tag to introduce local experimentation where remote students can perform hands-on sensor measurements, create their own web page instruments and also post their web page instruments into the general framework for other remote students to use.

Keywords - Wi-Fi tag; iLab; Web Page Instrument

SUMMARY

Wi-Fi tags with measurement capabilities are connected to sensors in order to send measurement data via wireless Access Points to the Internet. Data from sensors is made available on the Internet for dedicated computers to do logging into databases, analysis, simulation and modeling, data mining, and presentation using web pages. Client computers anywhere on the network can access these WEB Instruments. The concept of WEB instrument moves virtual instrumentation from the computer based space into the Internet space, everything except the physical I/O will take place on the web. The iLab

remote laboratory framework can greatly benefit from using WEB Instruments powered by Wi-Fi tags. Remote students will use the tag as an extension of the remote framework, in order to perform local or “home based” experiments that are part of the general framework but physically executed locally. This is a great combination of virtual experimentation with local flavor. Students can post their web page instruments in the framework for other students in remote locations to use them with their own tags. Work is done currently to create a community of web page instruments that connect sensors to the Internet.

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Session: 03F Area 1: Open Source, Open Standards, and Federated Systems

Open Source Learning Management Systems in E-Learning and Moodle

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WikiDIS: a case of collaborative content management system for educative community

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An enterprise e-learning solution: The UNED practical case in the EHEA

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Educative use of simulators in free software for the education of the physics in the engineering programs

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Open Source Learning Management Systems in E-Learning and Moodle

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Abstract—In the last decade, the effect of Internet usage in education has increased gradually and new technologies have improved student's learning. By using distance learning tools, the student education can be more flexible with respect to place and time constraints. So, students can access information in every time and everywhere either in libraries or during the lectures. As is widely known that, distance learning is costly, and cost-effectiveness becomes more important as the institutions become large-scale providers of distance education. Cost which is the most important disadvantages of distance learning according to traditional learning environments can be removed with the extensive features of the Open Source Software. Generalizing the usage of Open Source Software will provide development of learning tools and increases the educational quality. As far as the literature is reviewed, not much research has already been conducted about the comparisons of open source learning management systems in distance education. In this study, some analyses and comparisons were made about open source learning management systems and Moodle was outstanding with many features among other LMS that aims to improve the educational quality and include the tools that an e-learning system should have.

Keywords—component; Moodle, Open Source LMS, Learning Management System, Distance Learning

I. INTRODUCTION

The tremendous improvements in information and communication technologies and increase in the use of internet brought lots of opportunities to different fields and also Instructional Technologies. Based on the new technologies, learning environments are able to provide a wide range of educational alternatives for learners. Distance learning is one of these alternatives which became attractive where student and instructor are physically in different location and time [9].

In relation Miller R.L states that, more and more educational institution and companies are adopting distance learning methods to train and develop their employees, because it delivers more training to wide range of people for the fewest cost [5]. What is more, studies show that, it is also effective through including e-learning tools, such as;

e-learning technologies reduce the learning time requirements by an average of 50 percent and retention rate of the trainees greater with e-Learning including interactive than with a solely classroom based model [11].

Learning management System (LMS) which have a significant role in distance learning is also known as the Virtual Learning Environment (VLE) or Learning Platform. Hall defines an LMS as: "software that automates the administration of training events [2]. All Learning Management Systems manage the log-in of registered users, manage course catalogues, record data from learners, and provide reports to management." The definitions of LMS systems and related terms encountered in this article are discussed in further details in the article Online Education: Discussion and Definition of Terms [11].

Many organizations are using learning management systems (LMS) to support and to improve learning within their institutions. According to Observatory on Borderless Higher Education, some higher education institutions continue to develop in-house systems or buy into open source alternatives, but an ever-larger majority is purchasing licenses for proprietary platforms [1]. However, the open source LMS may have an impact on the future LMS market with its cost effectiveness and advanced features.

WikiDIS: a case of collaborative content management system for educative community

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Abstract—In this paper we describe a collaborative content management system based on Wiki Technology. This system, named WikiDIS, is designed to be used on a collaborative way by all persons who are part of an educational community (students, teachers, administrative staff, etc.) Functionalities of WikiDIS are friendly editing, editing and publishing workflows adapted to different types of users and communications facilities. The main functionalities and design aspects are explained in this work.

Keywords—*Web technology, Wiki technology, collaborative work, content management systems.*

SUMMARY

A content management system is a tool for creating, managing, publishing and presenting of contents on a reliable and friendly way using the web technology. We describe the functionalities and main aspects about the design of a collaborative content management system developed by us that we have called WikiDIS. This tool permits the editing and publishing of contents related to the activities of an educational and academic environment on a collaborative way. Specifically, WikiDIS has been developed to use by the community of the Computer Science and System Department of the University of Las Palmas de Gran Canaria, in this context community means all the people which participate in an educational community, such as: pupils, teachers, administrative and services staff, academic authority, etc.

WikiDIS is a tool based on Wiki technology; really WikiDIS is an evolution of the software tool called MediaWiki (GPL license software) for this reason WikiDIS has functionalities such as: friendly editing of the web contents, using WYSIWG editor, building and publishing workflows adapted to the different users profiles, tools to translate for different languages (about 100), control of versions and control of expired contents. Moreover, it incorporates resources for user communication (email, chat, forums) and tools for loading and unloading of multimedia contents.

In WikiDIS all the relevant elements that participate in the educational and academic activities are represented by entities, these entities are structured in three categories: people (pupils, teachers, administrative staff, etc.), academic management (directive staff, academic council, commissions, etc.) and subjects. The entities have different types of capabilities for

editing, publishing and visualizing of contents depending on the activity performed, for example: organizing, coordinating and controlling of the subjects teaching, resources managements related to the educational and academic activities, building, updating and publishing of documents (manuals, procedures, teaching projects, regulations, etc.). Additionally, WikiDIS supports the contents managements related to the teaching tasks of the subjects realized by pupils and teachers.

To achieve all the design goals, we have developed and integrated new modules in the MediaWiki tool, specifically in two modules named logical level and data level. In the logical level, new PHP scripts and extensions have been added in order to incorporate new contents and functionalities to the database, for example the content management required by subjects and groups of them. Moreover, several files have been modified to contemplate the characteristics of the workflows of the academic and educational tasks. In the data level of MediaWiki, we have modified the design of the database introducing new tables and fields. As a result WikiDIS has the same architecture of MediaWiki (layered architecture), but different structure because it incorporates new components and functionalities, for example three new sections, named prefixes, subjects and chat, are available in WikiDIS. For this reason, we can affirm that WikiDIS is an evolution of MediaWiki; this evolution is specifically oriented to the educational environment.

We have developed a tool based on Wiki technology; specifically it is based on MediaWiki that is GPL license software. The developed tool, WikiDIS, is an evolution of MediaWiki oriented to the educational ambient. WikiDIS is a collaborative content management system that permits on a friendly way the collaborative work of all the educational agents (pupils, teachers, educational authorities, etc.)

Nowadays WikiDIS is implemented in the Department of Computer Science and System of the University of Las Palmas de Gran Canaria; it is formed by 102 members who teach in 102 subjects associated with 13 academic qualifications followed by over 1200 pupils.

An enterprise e-learning solution:

The practical case of the UNED in the EHEA

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Abstract— In this paper, the European Higher Education Area (EHEA) adapted technological model is presented, developed in order to provide the e-learning solution for the new grades of the Spanish University for Distance Education (UNED). The transition of UNED's e-learning users to a new platform must focus on user experiences, so WebCT (used in the university from the beginning as its e-learning platform) and Moodle (open source e-learning platform with numerous implementations in other universities) were analyzed from a user's point of view. This analysis allowed a set of interfaces/tools to be defined in order to fulfil the user requirements for the UNED enterprise e-learning system, called aLF (active Learning Framework). Actually, the new version of aLF has implemented the new improvements in order to start a successful transition.

Keywords- user experience; e-learning platforms; enterprise e-learning system; adaptation; customization

SUMMARY

The Spanish University for Distance Education, UNED[1], is the largest public distance education university in Spain with over 200,000 students, 1400 lecturers and 2000 administrative staff. It has been in existence for more than 30 years. Since it is a distance education university students do not come to a central campus to receive their teaching. They attend regional study centres. There are currently over 60 of these study centres distributed throughout Spain and Europe. As well as the lecturers the university also has 6900 tutors working in these study centres. The tutors are an important figure in the teaching process because quite often they are the main contact the student has with the university. They provide the students with support in many ways, for example, giving taught classes, leading laboratory sessions, and helping to resolve any problems the students may have with the subject being studied.

One of the key features that sets the UNED apart from other distance universities is its consistent commitment to innovation, both methodological and technological. As such, it is evident that ICT (Information and Communication Technologies) has always had an important role within the UNED. Over the years its use has grown and currently forms an important part of the university's activities. As well as the online teaching activities it is also used as part of the administration process (where the UNED is moving towards the position of being a paperless university), admissions (where

more than 90% of student admissions are being undertaken via Internet), and examinations (where the exams are no longer transported to the local study centres on paper but as encrypted electronic files). However, without a doubt the most important application of ICT in the university has been the development of our own online community-based learning platform, aLF (active Learning Framework), for use in our virtual campus.

In the UNED, due to its very distance education-based nature, all ICT used has to be EIS (Enterprise Information Systems). Any EIS should by definition be robust, scalable, OS portable, and interoperable with other systems. The currently popular PHP-based e-learning platforms (Moodle is the most popular solution in the open software area) do not fulfil these requirements, and hence, any application for large student numbers requires custom ad hoc solutions, which is far from perfect. Since aLF is built over dotLRN, which is an EIS, it is inherently robust, scalable, etc., as any system of this type should be.

However, in the UNED, all the e-learning users are accustomed to working with the WebCT environment so the portlet based interface of aLF (the standard view in web applications) was not easy for them to use. Focusing on the UNED user's experience, a new interface has been developed adding some icons/tools functionalities of WebCT 4.x. Furthermore, the influence of Moodle users in the methodological approach of the UNED lead to the development of a new planning tool that behaves like the Moodle tool. With this tool, the UNED Moodle users will be more at ease with the e-learning platform. Additionally, more improvements based on the WebCT and Moodle experiences were added. In the paper, the EHEA fundamentals and their importance for the UNED, and its need for a robust enterprise learning management system, will be presented. Also, the tools developed in order to get a full new interface and tools oriented to the EHEA specifications, and based upon best practices taken from WebCT (the UNED's Learning Management System before 2009) and Moodle (a lot of users have been working with it), are detailed.

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Educative use of simulators in free software for the education of the physics in the engineering programs

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Abstract - See of the necessity that the education has of incorporating the technologies of the information and the communication TICs to the teaching-learning processes. The investigation group TICA: Technology, Investigation and science applied since for several years come developing projects of incorporation of TICs in the education.

One of these projects is the one that today is presented in this document and whose purpose has been to identify solutions of educational software: simulation systems, virtual educational environments, educational software, among the most outstanding. But with an added value that you/they should be developed standard first floor of free software that you/they guarantee their use, modification and execution without restrictions for the final user or the institution that he/she wants to use them.

Around this topic you beginning an investigation from the year 2007, which begin with the topic of pretenders developed in free software for physics, when going developing this topic was being identified all kinds of solutions of free software, making with it that in a parallel way you began to inventory these solutions.

Today per today they have been identified near 2500 solutions of free software among pretenders, learning environments and other solutions with educational use.

And seeing this great volume you design a repository of pretenders in free software which has been denominated Open Simulates Source. This portal has as purpose to index all development of free educational software.

Keywords-component; e-learning and learning colaboratives environment, simulation, educational software, open source educational software.

SUMMARY

The free software has penetrated today per today all the areas of the knowledge and of the development of the society, its organization and development model has allowed him to be positioned like a true solution to the necessities and computer of the current world.

This work is approached through several units, those which in turn are subdivided to analyze the topic and to present them results. The units are:

- The Unit 1. Introduction of the project research
- The Unit 2. Identification and classification of the software
- The Unit 3 Advances of the use of free software in the education
- The Unit 4. Phases of development project
 - 4.1. Identification phase and documentation of software resources
 - 4.2. Design phase and development of the repository of the software resources
 - 4.3. Identification of the educational methodology and the design of implementation guides phase.
 - 4.4. Application phase
 - 4.5. Phase of I diagnose
- The Unit 5. Methodology Research
- The Unit 6. Analysis of results.
 - 6.1. Identification of resources for software type.
 - 6.2. Identification of resources according to the development language
 - 6.3. Identification of resources according to the type of distribution License
 - 6.4. Identification of resources according to use platform

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Session: 03G Area 3: New Frameworks for Engineering Education

Engineering societies as a vehicle tool for engineering students.

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IEEE Student Branch UNED (Spain)

Knowledge, skills, and competences -- Descriptors for Engineering Education

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**Implementation of An Engineering Educator Graduation Program for the
formation of New Skilled Engineering Teachers**

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enginy@eps: Motivating the Engineering Courses

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Engineering Societies as a vehicle tool for engineering students

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Abstract—This paper describes the importance of Engineering Societies inside the educational environment, focusing on the new learning models that appear in the student branches. This model involves pedagogical methods different than the more formal ones used in the classrooms. They are based on more informal approaches where learners are the real center of the process and teachers appear just as tutors or learning drivers, providing the required material and support to learners. The paper describes the successful experience of a Student Branch in a University for Distance Education, overcoming the traditional collaboration and interaction lacks that these kinds of institutions own due to its inner organization and learning methodology.

Keywords: *Engineering Societies; Student Branch; blended learning; active learning.*

SUMMARY

Engineering and education Engineering Societies play an important role inside the university environment, due to that they can become a vehicle between university and industry, helping learners to acquire different knowledge than the provided by the formal education. This knowledge could be an important added-value for students when they arrive to work market because they will own more knowledge, experiences and capabilities than the other applicants [1] [2] [3]. These new skills will be the key for their future professional development.

In addition, active participation on these Societies can help learners to improve their self-learning abilities, because they must learn by themselves many technical concepts to put them into practice [4] [5] [6]. They also improve their social skills, such as leadership; capacity of organization of projects, talks, workshops, publications, etc; and work scheduling (for themselves and for the group). On the other hand, other advantages are the improvement of their own technical knowledge in the areas where they are interested (they have access to the latest information about technology), social networking and knowledge about other cultures (with other students or professionals interested all over the world).

But in these groups usually learning does not happen spontaneously. Some kind of impulse is required to encourage students to participate in an active way. Usually, it happens through the participation on contests (e.g. robotics, programming, networks, etc.) or in interesting projects to

achieve a particular goal. Other incentives for the involvement can be attendance to technical talks, workshops or publication of papers on journals or conferences. Enjoy, learning and success are guaranteed when a student is suitably motivated.

A very good example of the successful implantation of these Societies at Universities in IEEE Student Branch of UNED (Spanish University for Distance Education). This group has overcome the problems of being the members spread all over the country [7]. The paper describes the distributed organization of this group and the use of virtual tools to support the communication and collaboration among members.

Engineering and education Engineering Societies arise as a very good vehicle to complement the formal education, providing at the same time experience in real projects that will be very useful in the integration within the work market. This new complement together with a new kind of peer relationship with the faculty members that collaborate under the students direction in the organization of activities of the Branch preparing the students for the integration in the professional market in a very effective way.

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Knowledge, Skills, and Competences

Descriptors for Engineering Education

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Abstract—Since the European Parliament has given an according recommendation, qualifications are to be described in terms of knowledge, skills, and competences. In this paper, these terms are redefined in a way that they are put into relation to learning-models, thus making possible to describe qualifications in engineering education in a more rigorous and verifiable way.

Keywords—education; qualifications frameworks; assessment

SUMMARY

In 2004, the Ministers of 32 European countries, responsible for vocational education and training, decided to create a European Qualifications Framework (EQF) with the intention to provide a tool for transparency and comparability of qualifications in Europe. This framework uses the categories “knowledge”, “skills”, and “competences” to describe qualifications on eight levels.

Since different branches of science use these terms in different contexts and with different meanings, re-definitions of the terms “knowledge”, “skills”, and “competences” are given:

Knowledge related to a field of work or study, means the learnt, retrievable information on facts, the context, to which facts are associated, and the rules interrelating facts to contexts.

Skills means an ability that has been acquired by training and that makes use of the implicit memory, to apply knowledge to *standard* situations, and to use know-how to complete *standard* tasks, and to solve *standard* problems.

Competence means the proven ability to autonomously recognize interrelations between facts and the contexts to which they are linked, to apply this ability to systematically develop new methods, and, if indicated, to apply them to changed situations. This includes application to work or study situations, and in professional and personal development.

In a strongly condensed form, it might be said that in the sense of these definitions, knowledge is learnt by heart, skills are acquired by training, and competence is developed by using sense and intellect.

Using these definitions, learning success might be tested more specifically. Some testing procedures are described in the full paper.

Application of the EQF to simple examples shows that for an adequate assessment, it does not suffice to specify the highest level of qualifications. Rather, any assessment must be accompanied by specifications of what has been assessed, in what field, in what width (i.e. which subfields are covered), and on what level. The result would be a *profile* of knowledge, skills, and competences in subject-specific fields as well as with respect to the fields of social and individual behavior.

Such profiles do not only characterize much better, which potential an individual with this profile has, they reveal in addition principal weak points of the EQF, e.g. problems with the comparability of two qualifications with same label and same level but different width and deepness of knowledge, skills and competences.

Implementation of An Engineering Educator Graduation Program for the formation of New Skilled Engineering Teachers

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Abstract — COPEC - Council of Researches in Education and Sciences education team has designed a new program in graduation level: the Professional Engineering Education. The goal is to improve the formation of the engineering educator providing them with all the competencies needed to teach at the state of the art with the best available teaching technologies. The PEE Program offers two graduate degrees: the Master of Science and the Doctor of Philosophy. It is a very dynamic and rich program, developed in modules, following the trend of global formation of professionals, mainly to attend the need of a prepared engineering educator to act in the several different cultural environments, which mobility has imposed as a fact of life for researchers and teachers at graduation level. Not to mention the necessary new competencies of educators such as: evaluation management; development competencies; communication skills; teamwork; ethics and intercultural competencies. So this program has been designed to fulfill this lack of engineering educators.

Keywords: Education sciences, competencies, technology, intercultural skills, qualification

SUMMARY

Education without any doubt is a science in constant construction like any area of men's life: dynamic, challenging and alive. Many Institutions of Education worldwide have been seeking for the best ways to provide high level education. However quality in education speaking about what is called of technical competence is essentially the use and dominium of the cognitive means of teaching learning process as well as the available technological means. This level of quality of education has the dependence and straight relation to the teacher and his/her qualification and competence. Good programs have good motivated teachers in addition to modern installations and dynamic planning. The Faculty of any Institution of Education is one of the most important element, which provides or not its qualification of excellence [01]. In order to fulfill a lack of engineering educators for high education for engineering and technological fields in the country COPEC - Council of Researches in Education and Sciences education team has designed a new program in

graduation level: the Professional Engineering Education. The goal is to improve the formation of the engineering educator providing them with all the competencies needed to teach at the state of the art with the best available teaching technologies.

The so called PEE Program offers two graduate degrees: the Master of Science and the Doctor of Philosophy and it is a very dynamic and rich program, developed in modules. It follows the patterns of IGIP - International Society for Engineering Education registration for Engineering and Technology, the qualifications and professional experience at an advanced level. This society provides a title that has been recognized in several countries in Europe and now spreading all over the world. The engineering qualification should correspond preferably to "Europe Ingenieur (EUR-ING)" qualification for FEANI. In Brazil it follows the defined patterns for CFE/CREAs – Federal System of Engineering in the engineers' case and of the organizations responsible for the other professionals of Technology area [02].

It is a great achievement for academic midst once it can provide for engineers and professionals of technological areas the opportunity to update the knowledge about education as a whole. It is important to point out that it is a very dynamic program once the content of the courses can be developed constantly taking into account the characteristic of the groups. This aspect is relevant because it helps to overcome the obstacles such as communication problems, stress management and so on. The number of professionals interested in the program is growing and it is expected a larger number of attendees for next group. Besides the professional receives a diploma that is recognized national and internationally.

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enginy@eps: Motivating the Engineering Courses

Social Valuation as a Motivation Factor

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Abstract— This paper presents an academic initiative to increase the motivation of students for engineering topics, and discusses the results obtained. The initiative is a journal where students may publish, both in paper and in electronic format, the final reports of their laboratory works or research activities. The name of the journal is enginy@eps. The existence of this journal becomes an external element for motivating the students, since their documents are going to be reviewed by an editorial staff and are going to be published out of the classroom. The collected data shows that social recognition is still a useful element to motivate the students in technical courses.

Keywords- student motivation; educational innovation; formal writing profile

INTRODUCTION

In the last subjects of engineer courses, students participate in autonomous works, research activities and laboratory sessions where it is necessary to go further than just to apply previously learned concepts. This kind of activities requires a lot of time and hard work not only from the students but, also from the teacher. Finally, once the work is evaluated for the course, it is usually forgotten and often the work conclusions are not used anymore. So, it seems contrary to the student's and to the teacher's motivation to foresee that their efforts will not be useful to anyone else, and that their work will be forgotten when the course ends.

The student motivation is a complex topic, and it is difficult to quantify [1]. In some cases, the same thing does not motivate all students at the same time. Two factors that impact on student motivation are: the social valuation and the perception of the expectation of success [1]. It is important to note that both factors are part of a multiplication equation, so if anyone of these factors is zero, the result is zero too. This means that, the student must find some positive attraction toward the educational activity, but in addition, it is necessary a positive perception regarding the accomplishment of the learning activity. There are a lot of learning environments proposed to increase the students' motivation, as an example in [2] and [4] a game based learning environment is used to increase the motivation of students in different courses.

Furthermore, the students in first courses, in general, have initiated the Engineering careers without a clear idea about the

topics and issues related with those courses. They may have no idea about the concepts and methodologies involved in their engineer courses. And they have difficulties to explain the reasons why they have selected these particular courses instead of some others. This initial confuse situation may be a disinclining factor; and it is difficult to know how many students leave the recently initiated studies by that reason.

Some different solutions have been proposed in our University to help students to solve this confuse situation as soon as possible: pre-university labs, adaptation courses, classrooms open door day, or talks about the features of different courses. All these solutions have a point in common: the university presents the information about their courses mainly from an institutional point of view. These solutions not provide information about the real activities developed in the classrooms or directly obtained from others students.

From another point of view, but related to the proposed work, it is necessary to take into account that, all engineering activities and results have to be explained and summarized in any technical document. So, it is not only necessary to learn good competences in technical engineering topics, but it is also necessary to acquire good technical writing skills. Cockrum et al. in [3], propose some ideas of how to design writing courses, to help students to acquire those necessary generic competences.

In this study, we propose to learn writing competences not in a separate subject, but in several subjects at the same time and in combination with each specific subject contents.

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Session: 04A Area 4: Learning Models - Learning tools

A computational introduction to STEM studies

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A Tablet PC-Based Teaching Approach using Conceptual Maps

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M-learning tools on distance education

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Teaching Digital and Analog Modulation to Undergraduate Information Technology Students Using Matlab and Simulink

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A computational introduction to STEM studies

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Abstract—We report on the content and early evaluation of a new introductory programming course “Media Propelled Computational Thinking,” (abbreviated MPCT and pronounced iMPaCT). MPCT is integrated into a freshman-level program designed for under-prepared students with interests in a STEM discipline. It is intended to reduce attrition rates by fostering student intuition in, appreciation of, and confidence about basic pre-calculus concepts.

The MPCT curriculum is problem-driven, with analytical challenge exercises that are intended to motivate inquiry and to illustrate the reasoning used in the STEM professions. Preliminary evaluation results are encouraging – students from a wide range of academic majors found MPCT engaging, and report that the course conveyed insight, and decreased anxiety about foundational mathematical concepts

Keywords—component; introductory computing curriculum, CS0, MPCT, entering students program, CCLI, CPATH.

SUMMARY

We report on the content and early evaluation of an introductory programming course titled “Media-Propelled Computational Thinking” (MPCT) [5] that is intended to retain students in STEM areas by strengthening their understandings of pre-calculus concepts.

At UTEP, MPCT has evolved into variants taught with the introductions to several of the STEM subjects. The original version was integrated into some of the Entering Students Programs (ESP) [4] attended by entering freshmen at the University of Texas at El Paso, a primarily Hispanic-Serving Institution (HSI) serving an economically disadvantaged binational urban area on the US-Mexico border. The ESP course is designed to help students develop the skills necessary for academic success, and to assist students in career selection. Consequently, half of the ESP course addresses issues such as study, note-taking, presentation, writing skills, and career guidance. The other half features a technical content module such as MPCT. Its purpose is to present an engaging broad-brush perspective about learning technical content.

Introductory courses for technical disciplines such as computer science can only provide a limited set of activities. One of the main challenges we faced in the design of MPCT was how to use our very limited classroom time in a way that is not only engaging, but that first and foremost improves student readiness for calculus and the challenges of mathematical

reasoning. At UTEP, students often have to spend four semesters in remedial and background classes before enrolling in a first course in a STEM major. Consequently, we needed a half-course that could enhance student interest in CS, while simultaneously providing enough mathematical intuition to improve student retention in the high-attrition STEM majors. In the process, the course evolved to be relevant for students in a variety of STEM and non-STEM majors.

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A Tablet PC-Based Teaching Approach using Conceptual Maps

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Abstract— There are clear evidences that technology can drive major positive changes in the classroom addressing problems associated with traditional lecture-based pedagogy. In particular, the flexibility of Tablet PCs and digital ink has the potential to achieve a wide range of educational goals and promote a more dynamic classroom environment. However, as the possibilities of these educational technologies grow, it seems necessary to consider their role by conceptualizing the knowledge they provide. In this work we propose a teaching approach based on the use of conceptual maps to generate instructor guidelines for Tablet PC-based courses. Our approach combines the instructional domain with the technological one in order to offer practical guidelines to design and develop both lecture materials and active learning experiences, providing a systematic and flexible way to guide the teaching process in a Tablet PC-based learning scenario. We present a case study on how to implement the approach in a first-year Computer Engineering course reporting the introduction of the Tablet PC in this educational setting.

Keywords- Tablet PC; Digital Ink; Conceptual Maps; Instructional Design

SUMMARY

Recent research demonstrates obvious advantages of using Tablet PCs in higher education. In fact, there are clear evidences that technology can drive major positive changes in the classroom, addressing problems associated with traditional lecture-based pedagogy [1].

However, we think that any random implementation of educational technology has a low probability of success and widespread adoption. We consider that clear guidelines are required to develop and deploy such new technology settings. There are different tools to represent and organize these knowledge items and we have selected conceptual maps [2] as one of the more flexible and powerful techniques to support this process.

In this work we propose TAGGE (*Teacher Assistance Guideline Generation Engine*), as a teaching approach to generate instructor guidelines for preparing interactive face-to-face courses supported by technology. Based on the learning requirements of a specific educational setting, TAGGE uses conceptual maps to model the instructional domain and the technological domain in order to provide clear teaching guidelines, i.e., the outputs of our approach. In order to

illustrate the proposed approach, TAGGE will be applied to a specific context. On the one hand, Computer Technology (5554), a first-year compulsory course in Computer Engineering has been chosen to describe the instructional domain. On the other hand, Tablet PC devices have been selected as the technological elements in this context. Learning requirements represent the inputs that help to describe the specific context. Concerning the Computer Technology course, over the last five academic years have been observed the following problems: a) pupils' lack of motivation; b) low class attendance rates; c) high course dropout rates; d) low participation and student interaction, and eventually, e) poor students' performance.

The first step of our approach consists in feeding them to our instructional domain in order to decide which are the basic instructional concepts we should focus on: a) in-class activities should be emphasized; b) those didactical resources that promote student participation should be strengthened; c) assessment strategies should be shaped in order to track learning attainment in a continuous way. The second step of our learning approach connects those basic concepts coming from the instructional domain to the Tablet PC domain. Thus, it leads us to exploit the inking functionalities and to select which services fit better our instructional issues. In our particular case, we observe that: a) delivering services can contribute to foster student participation and cooperative learning; b) desktop sharing services can help to take the best use of multimedia resources or computer tools and, at the same time, also facilitate the student active role; c) polling services can assist both students and teachers to obtain timely feedback about student attainment, and to facilitate mechanisms to adapt the teaching strategies to the learner's needs.

The former approach was applied during the spring 2009 semester to a pilot section of the Computer Technology course and it has revealed a higher degree of students' engagement and an improvement in class attendance and students' performance.

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M-learning tools on distance education

Overview and Case Study

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Abstract—This paper shows a pioneering project in education with the use of cell phones and other mobile devices. The mobile learning environment was developed by Fazion Sistemas and currently is at the Universidade Fernando Pessoa (Portugal). The paper presents an overview of mobile-learning concepts, its barriers, challenges and trends.

Keywords- *m-learning; distance education; mobile application, mobile learning; e-learning; engineering education.*

SUMMARY

Today people are used with mobile phones, and pay to communicate with people whom they like or with whom they work, either through direct conversation or by exchanging messages. In fact, the text messages play a very limited role in communication, either by poor information quality or high costs. While the “idea” of the personal computer largely derived from the look of a typewriter and calculator, usually born in the company, the phone came from the merger of the notebook and telephone, being something very personal.

We must learn from this change - home versus business – and what should be done to enhance phone quality when developing applications. Today, more than ever, businesses are stepping forward to bring people together because people like to relate to each other, regardless of business they do. If a mobile network project can be developed in this format, aimed at relationships, then this is the path. [1]

Currently there are three areas where mobility can bring immediate fruits and strategic importance for organizations, which are “mobile-business”, “mobile-commerce” and “mobile-learning”, or simply “m-learning”.

M-learning can be considered an offshoot of e-learning. But, in fact, considering that e-learning enabled the distance learning using the Internet, m-learning goes beyond by allowing the user access to perform anywhere, even on the move, and the device becomes in fact a mobile repository of information. The concept of education with the use of mobile phones covers a wide range of opportunities:

- learn anywhere and in motion, simply carrying a personal mobile device;
- learn by interacting with different people through

social networks, forums, etc.;

- archive and order a wide range of information, using memory resources of the device;
- create, with equipment features, image files, video or text, attaching them to the systems of communication and learning;
- consult various information such as grade, messages, calendars, among others.

This paper does an overview about m-learning and shows a pioneering project in education with the use of cell phones and other mobile devices. The project is at Universidade Fernando Pessoa (Portugal) and the basic system refers to academic information such as calendar, information about the subject, grade and environment forum between students and teachers. Universidade Fernando Pessoa uses a very successful e-learning environment based on the *sakai* collaborative platform [2] and sees it as a natural expansion of e-learning environment towards m-learning.

The m-learning project presents several challenges and barriers to transpose, either on technical or cognitive issues. As an example, there is no standardization on the several mobile platforms or devices, screens vary from device to device and the industry is not worried about data traffic or computation basis when compared to voice traffic and its respective earnings. The cognitive aspects of mobile learning is yet more obscure, as the research on this area is just in its very beginning and depends on new experiments and trials.

The project with Universidade Fernando Pessoa is a real case use and is also object of study and research. The paper begins with an overview of mobile learning concepts and describes the context of the project at Universidade Fernando Pessoa.

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Teaching Digital and Analog Modulation to Undergraduate Information Technology Students Using Matlab and Simulink

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Abstract—Teaching mathematical intensive engineering based courses to undergraduate Information Technology students poses a great challenge to instructors. In this paper we provide an efficient and effective method for teaching digital and analog modulation to undergraduate students enrolled in an Information Technology program which does not require a strong foundation in mathematics as in the case of an Engineering program. The used approach utilizes Matlab packages, Simulink, and Communication Blockset to simulate analog and digital modulation techniques avoiding the derivation of any mathematics formulations and without coding. A survey that was distributed to Information Technology students who were taught using this approach showed a high level of satisfaction in understanding all modulation concepts.

Keywords: *Matlab; Modulation; Simulink, Communications Blokset*

I. INTRODUCTION

Matlab is a numerical computing environment and a 4th generation programming language. It is a high level language and interactive environment that enables users to perform intensive calculations based tasks very fast. Developed by Mathworks [5], Matlab allows matrix manipulation, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs in other languages. Matlab has been widely adopted for over 25 years in the academic community, industry and research centers. It was originally written to provide easy access to LINPACK and EISPACK software packages [1-4]. The Matlab software provides the users with a large collection of toolboxes and modules for a variety of applications in many fields of interest.

Simulink [6] is an interactive graphical tool that was added to Matlab to make the modeling and simulation of various systems as easy as connecting predefined and designed building blocks. Simulink contains many block sets that are used in almost all applications such as the communication block set and the signal processing block set.

In this paper, we provide an efficient and effective method for teaching digital and analog modulation techniques to undergraduate students enrolled in an Information Technology program which does not require a strong foundation in mathematics as in the case of an Engineering program. The

used approach utilizes Matlab and Simulink blocksets to simulate analog and digital modulation techniques. To assess the degree to which Matlab/Simulink helped students to understand the taught concepts, a survey was distributed to students and the results were analyzed using Statistical Package for the Social Sciences (SPSS [7]) and presented in this paper.

II. CONCLUSION

A survey that was distributed to 57 Information Technology students who were taught using this approach showed a high level of satisfaction in understanding all modulation concepts. As can be seen from the survey results, students expressed a general consensus towards their agreement of the benefits of incorporating Matlab with Simulink in their course. Most of them, for instance, claimed that the Matlab with Simulink component was very useful for helping them understand the theoretical aspect of the course, thereby increasing their knowledge based on the subject matters.

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Session: 04B Area 4: Active Learning - Project based learning

Research-based approach application for electrical engineering education of bachelor program students in Riga Technical University

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Learning by doing in Project Management: Acquiring skills through a collaborative model

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Integrating Teams In Multidisciplinary Project Based Learning in Mechanical Engineering

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A Project-Based Learning Approach to Teaching Power Electronics

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Research-based approach application for electrical engineering education of bachelor program students in Riga Technical University

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Abstract—Research based approach in education is important for engineering specialties. The implementation of this approach is interesting for students also. The research possibilities involve all level of education process: pupil's interest is higher, average mark of students is increasing; the number of graduate students is increasing with introduction of research-based approach.

Keywords- *Research-based approach, electrical engineering , bachelor program*

SUMMARY

The education in Power and Electrical Engineering is set as priority in many countries, because people have to find ways to substitute petroleum and natural energy resources, which are decreasing in the world each day.

The paper sketches the details on how the research component is introduced in the curriculum of the Computer Control of Electrical Technologies programme at Riga Technical University.

The use of project-based learning method is important methodological issue to get sustainable development of economy in Latvia. There is description on PBL application given in the article: how to attract new students using research (Annual project week inviting secondary school pupils). The partnership with industry is also interesting by providing industrial experience to students and providing research facilities for industry. The idea of the student scientific conference is also described. The PBL introducing in RTU is

important, for developing innovations, and technical progress in Latvia.

The research possibilities involve all level of education process: pupil's interest is higher, average mark of students increase; the numbers of graduate students are increased after introduction of research-based approach.

The analysis of case study at IEEI, which is a leader in RTU in project-based learning application, shows that such strategy application could give a two times increasing of the number of students at the program that in its turn increases the flow of financial resources of the institution more than two times as well as it can significantly improve the quality of education and the range of students' and further specialists' knowledge and skills.

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Learning by doing in Project Management: Acquiring skills through a collaborative model

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Abstract— This paper presents a teaching approach for an undergraduate course of project management under the learning by doing paradigm. The course experience as a whole is presented, including planning aspects for all scheduled activities, are provided later. The definition of the project is provided, as well as its specific details for practical project work, the main educative instrument of the course, in order to bring out the most relevant aspects of the approach. These include improving the learning process by means of a collaborative model and details of the assessment process that make continuous improvement possible. Detailed research to evaluate the effect of students' previous work experience of this learning model is also considered in this paper.

Keywords—project management skills; collaborative groups; interdisciplinary groups; engineering education; learning by doing formatting.

SUMMARY

The participative model presented shifts the active role to the student, given the fact that he is the one who needs to solve the problem after he has validated his approach. The teaching approach involves a combination of several topics in an endeavor to reinforce the learning process itself. These topics are:

- Practical work focused on managing a real project, mainly in its beginning stages (preliminary scope of the work, feasibility analyses, technical and tactical scope of the work, design, documentation and customer presentation).
- Competition among teams of students.
- Transforming theoretical course material from a time oriented presentation to a practical presentation of contents that enables them to become of direct use in practical work.
- Combining different roles and responsibilities within each student team in order to improve the learning process that results from internal discussions in which students adopt different roles.

The learning approach presented concerns the development of a real engineering project by groups' competitive

assignments. The main purpose of playing to manage projects is to move on from simply learning contents by heart to understanding, discussing and sharing in order to learn from experience.

The subject of the project was chosen to ensure that several disciplines are involved, different solutions are possible and integrative solutions must be found in order to present a coherent solution to the customer. In this context, the students apply the project management methodologies and techniques that they learned during the course to enable them to make a sound proposal that meets the client's terms. Once the simulation of this model has been completed, it becomes clear that the proposed learning dynamics promotes the development of diverse knowledge competencies required to manage engineering projects.

Investigating the outperformance of teams according to their internal structures was of additional interest. In order to investigate the effect of previous work experience in developing the real project, two different teams were created for the case study that is under consideration, the first consisting entirely of young students who had no previous work experience and the second consisting of students who possessed significant previous work experience. Each project team represented a different consulting firm that had been asked by its client (the lecturer) to undertake an assessment of the project. The purpose of this practice was not only to enable students to acquire technical knowledge, but also to open their minds and see what engineering project management is really about. This experience has demonstrated that project-based learning is an effective way to promote student learning in project management. As demonstrated, this is a method of instruction that challenges students to learn how to work cooperatively in groups in order to seek solutions to real world problems. These problems are used to engage students' curiosity and initiate the learning of the subject matter. The inclusion of real-world problems in engineering education reinforces concepts and improves learning in ways not available with traditional lecture methods or predefined case problems. Students develop problem solving skills, project management skills, communication and teamwork skills, and a sense of professionalism from such experiences.

Integrating Teams In Multidisciplinary Project Based Learning in Mechanical Engineering

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Abstract— Mechanical/Industrial Engineering students at Higher Technical School of Industrial Engineering (ETSII) of Technical University of Madrid (UPM) receive an in-depth knowledge of mechanical design and manufacturing processes, but the increasing interaction with other engineering branches, induces the need to integrate concepts which allow students to make an integral design of new products, and thereby facilitate their subsequent integration into multidisciplinary engineering teams in industry.

Complex engineering projects are usually carried out by the assimilation of different work teams, which could even be located geographically distant. Collaborative Web environments are proven to be ideal knowledge repositories, as it has been in Academia and in Industry. The work here presented reproduces the organization of actual engineering projects, and brings it into the classroom.

This new way of developing Project Work documentation and discussion has helped students become self-directed learners who internalize specific topics from different subjects, programmes and courses with their own interests, and has been considered as an easy alternative to promote active learning, not only in this area but in other courses.

Project were launched in the engineering disciplines, each offering possibilities for the application of specific skills in the following courses: TEC -Manufacturing Technology-, CAD -Computer Aided Design-, SIM -Simulation in Mechanical Engineering-, and FAB -Fabrication / Manufacturing. TEC and SIM are applied in the Mechanical Engineering programme at ETSII, while FAB is part of the Industrial Engineering programme; finally CAD is voluntarily employed by students in different semesters and programmes. The new approach is oriented towards inducing collaboration within multidisciplinary teams.

This paper describes the experience of collaboration among students and teachers in order to develop multidisciplinary projects, and to reproduce as closely as possible, the team's integration into a company environment. A new methodology based on student interaction and content development in a Wiki environment has been developed. The collaborative server has allowed creating an "out-of-the-classroom" active discussion

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forum for students of different teams /topics, and to compile an important "project work" portfolio. This experience has been very satisfactory for students and teachers, who have participated with enthusiasm due to the exit of the well-distributed work and the easiness of use of the selected platform (Wiki). The quality of the developed projects has been dramatically improved due to the integration of the results provided by the different teams.

Keywords- Project Based Learning; Active Learning; Collaborative Work; Multidisciplinary Approach; Wiki Environment, Teaching Mechanical Engineering.

SUMMARY

The main objective of this experience has been to design a set of projects to be developed by students and where students have to work in cooperative groups of three and have to integrate their results with groups from three other different subjects. Section I introduces the need to integrate multidisciplinary knowledge which will allow students to make a whole design of new products and thereby facilitate their subsequent assimilation into multidisciplinary engineering teams in industry. Section II explains the used team organization, necessary to make a well distribution of the multidisciplinary Project Based Learning. In addition, this section is about the collaborative Web, in which is basically integrated all the information from student contributions and show it to the other teams with the purpose of enhancing the overall quality of the results produced. Section III shows the evaluation results that the students involved had to fill in a set of reports to evaluate team progress, in interaction with other members, problems, etc. These results are analysed statistically to obtain the necessary correlation between different questions. Finally, section IV makes some conclusions of the work.

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A Project-Based Learning Approach to Teaching Power Electronics

Difficulties in the application of Project-Based Learning in a subject of Switching-Mode Power Supplies

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Abstract— This paper presents the introduction of Problem-Based learning (PBL) in a power electronics subject at the University of Oviedo (SPAIN) by means of two practical projects: the design and construction of a Switching-Mode Power Supply (SMPS) prototype and the static study of a dc-dc converter topology. The objective of this change in the traditional methodology of the Power Electronics course is to foster the application of the knowledge acquired by students in theory classes. PBL is known to be a motivating, problem-centered teaching method that brings the real professional world closer to the student. For this reason, the lecturers considered PBL to be the most suitable methodology to obtain the desired results. The underlying methodology, task planning and assessment of these projects will be presented. Furthermore, the influence of the introduction of PBL in practical sessions versus the traditional teaching method will be discussed. Finally, the lecturers' reflections and conclusions regarding the application of PBL in this subject over the last two years will be presented.

Keywords- *Project-Based Learning (PBL), significant knowledge, power electronics, switching mode power supply, practical sessions.*

SUMMARY

It is well known that electrical engineers are recognized for their contributions to technology and for their improvements to global conditions. This is due to the fact that their main skill is the application of mathematics and scientific knowledge to the real world. However, traditional practical classes in Electrical Engineering curricula may obviate this fact because they are seen by students as a mere requirement without any interest in the real world. Therefore, the main skill involved in electrical engineering (the transfer of acquired scientific knowledge to society) is not enhanced because students do not see the real application of the work carried out in practical sessions.

On the other hand, the overall current aim of the Bologna Process is to create a European Higher Education Area (EHEA) based on international cooperation and academic exchange that is attractive to European students and staff from other parts of the world [1]. This means that all the undergraduate and masters degrees in Europe must have the

same structure. In Spain, this change in the structure of university degrees is being employed to change the traditional methodology used to teach. Taskplanning and methods must now focus on student learning. Therefore, we must use active teaching methodologies to obtain significant student learning as opposed to mechanical learning. Significant learning goes beyond just understand-and-remember and even beyond application learning. In other words, students build their own knowledge on the foundations of their prior experience and know-how [2].

Taking into account the aforementioned motivations, a team of lecturers at the University of Oviedo (Spain) introduced the Project-Based Learning (PBL) methodology [3] in a subject called "Sistemas Electrónicos de Alimentación" (Power Supply Systems) in the academic year 2007/2008. This subject, part of the final course of the Telecommunications Engineering degree, deals with Switching-Mode Power Supply (SMPS) and power supplies systems. The objective of this experience is to foster the application of the knowledge acquired by students in theory classes. In other words, the goal is to put into practice all the concepts regarding power electronics acquired during the entire course. For this reason, the lecturers proposed two projects to students: the design and construction of a SMPS prototype (boost converter) and the static study of a dc-dc converter topology.

First, this paper presents the methodology and task planning for the two projects. Second, the results of the application of PBL over the last two years will be discussed. Then, the lecturers in the subject present the main difficulties of the application of PBL after two years of experience. Finally, proposals aimed at improving the application of PBL for the current course and the conclusions will be presented.

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Session: 04C Area 2: Virtual Worlds for Academic, Organizational, Life-long Learning and training - Virtual environs

GE3D: a virtual campus for a technology-enhanced learning

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Dynamic Virtual Environment for multiple Physics Experiments in Higher Education

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Learning Dynamics and Control in a Virtual World

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Virtual University as a Role Playing Game

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GE3D: a virtual campus for a technology-enhanced learning

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Abstract—There are many learning management systems all over the world. But these conventional E-learning platforms aim at students who are used to work on their own. Our students are young (19 years old – 22 years old), and in their first year at the university. Following extensive interviews with our students, we have designed GE3D, an E-learning platform, according to their expectations and our criteria. In this paper, we describe the students' demands, resulting from the interviews. Then, we present our virtual campus. Even if our platform uses some elements coming from the 3D games world, it is always a pedagogical tool. Using this technology, we developed a 3D representation of the real world. We also propose a process of a lecture on the Programmable Logic Controllers (PLC's) in this new universe. GE3D is a multi-users tool, with a synchronous technology, an intuitive interface for end-users and an embedded Intelligent Tutoring System to support learners.

Keywords-component: virtual campus, Technology-Enhanced Learning, learning systems platforms, engineering education, Intelligent Tutoring System, Multi Agent System.



Figure 1. The entrance of the virtual campus



Figure 2. The amphitheater with an avatar.

Dynamic Virtual Environment for Multiple Physics Experiments in Higher Education

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Abstract— The transportation of a campus classroom and/or laboratory into a three dimensional virtual representation has changed remote learning, specially in engineering education. Our first collaborative virtual environment, a proof of concept, provides full functionality of one physics experiment, though there are still some performance issues to be resolved.

The next step for integrating TEALsim and iLabs in Sun's Project Wonderland is porting our system from Wonderland's version 0.4 to 0.5. Our goal is a system redesign in order to support adding flexibility to multiple physics simulations. The performance improvements in Wonderland 0.5 will allow a large number of avatars in our future scenario, where they will be able to run even more physics experiments, through a new 3D user interface.

Keywords—collaborative immersive environment; virtual worlds; Project Wonderland; iLabs; TEALsim; physics experiments, remote labs, visualization.

SUMMARY

In the past few years, especially due to the increasing availability of faster and robust hardware and software, 3D environments have become common technology. Virtual laboratories, scientific visualizations, and some collaborative work approaches are just some of the successful fields of 3D graphics applications.

One essential term is Virtual Environment (VE), which is a computer generated spatial environment, where the stimulation of diverse human senses gives the user a feeling of being immersed. Immersion means how deep the user is emotionally involved within a specific virtual environment [1].

Currently, facing a globalized education, a great research challenge for educational technology professionals is to build technology that not just supports the learning process, but also connect students and educators in a way so they can easily cooperate, even when both parties are geographically spread.

As a platform for providing collaborative access to educational materials, our first collaborative virtual environment provides full functionality of one physics experiment. This environment results from the integration of internet-accessible physics experiments (iLabs) combined with the TEALsim 3D simulation toolkit in

Project Wonderland [2]. Students and educators, represented as avatars, within this environment can remotely control experiment equipment, visualize physics phenomena generated by the experiment and discuss results. This environment was developed following the Technology Enabled Active Learning (TEAL) classroom idea to support social interactions, encourage student's active learning and interest, in an environment that fosters conceptual change [3].

This study explores the process of conversion of the TEALsim simulation package to the rendering engine jMonkeyEngine (JME), which is the graphics engine used in Project Wonderland version 0.5. Additionally, we have built a Wonderland cell class that can dynamically load TEAL simulations into Wonderland by the end of the research project. This will provide a collaborative environment similar to the current 0.4 version, but using the new graphics engine.

Furthermore, we implemented an automatic generation of the simulation's controls in the Wonderland environment either as buttons, sliders and other control elements within the 3D space or as elements in the Heads Up Display. These controls will provide the standard Java event handling model.

Therefore avatars have the ability to directly interact with TEALsim elements, including moving elements and activating sensors. Changes in the environment would be updated in real-time.

Finally, based on the latest research, this paper outlines the future research directions and challenges to overcome.

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Learning Dynamics and control in a Virtual World

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Abstract— Virtual worlds can support learning processes by providing visual aid that deals with the complexities of real life problems. Increasingly useful is the online use of virtual worlds and the associated technical and social interactivity. This paper describes the development of a virtual world in Second Life environment for dynamics and control learning, and outlines the use of this virtual world as a learning space in the elective course Process Systems Engineering. The outcomes based on lecturer's experience as well as on evidence from student feedback are reported and recommendations are made for the use of virtual worlds in Engineering education going forward.

Keywords- virtual world; Second Life; learning; dynamics; control; education.

The online classroom is becoming increasingly relevant in the modern connected world. For the purpose of experiential learning, i.e. laboratory and experimental based activities, many educationalists have developed online courseware targeted at experiential education. Some examples are given, for Chemistry laboratory education [1-3, 5], surgery [10], biology [10], physics [1, 2, 4], Chemical Engineering [6-8] mechanical engineering [6, 7, 9], and electrical engineering [6, 7]. The educational challenges are being met by clever utilization of information, communication and data management technologies. Most existing virtual labs take advantage of the simulation, connectivity and internet technologies but to date have the following limitations:

- (1) they remain simple in nature with limited features,
- (2) in almost all developments the laboratory is presented in a 2D interface,
- (3) offer low usability levels, i.e. students cannot see facial expressions and get body language cues.
- (4) offer low or no interactivity between the user and the virtual plant,
- (5) offer low levels of scalability, i.e. limited number of students can use a particular virtual instrument at any one instant, and
- (6) the simulations used are offline in many cases,

This has led to a high demand for online interactive multi-media environments that serve the goals of teaching and learning. Internet-based virtual worlds like 'Second Life' (SL) serve such a purpose very well. These environments allow students and teachers to interact with each other and with software agents through motional avatars, providing an advanced level of a social educational network service

combined with general aspects of a metaverse, i.e. not limited to the physical classroom. Students can explore virtual classroom space, meet other students, socialize and participate in individual and group classroom activities. These virtual worlds have generally been well accepted by Internet users, indeed well embraced by the younger generations. Such immersive virtual spaces are flagged as highly advantageous for teaching and learning, particularly because virtual reality can help deal with the scope and complexity of real world problems where traditional classroom and laboratory settings create limitations. Educationalists are therefore adopting these to aid in delivering courses and improve aspects of their teaching and learning. This now has become an active field of research that looks into the way students learn in these environments and to measure the levels of improvement to the learning experience.

This paper (a) describes the development of a virtual world in SL for dynamics and control learning, (b) outlines the use of this virtual world as a learning space in the elective course Process Systems Engineering, (c) reports on the outcomes based on lecturer's experience as well as on evidence from student feedback and (d) makes recommendations for the use of virtual worlds in Engineering education going forward.

ACKNOWLEDGMENT

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Virtual University as a Role Playing Game

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Abstract— Research and development in design of games for education focus on understanding better what features of games can be inherited to further motivate students and simultaneously improve learning outcomes. Since, a common design standard is not available for educational games solutions are usually carried out by an ad hoc process. In this paper, a novel approach to design this kind of games is presented taking into consideration key features of the most successful massively multiplayer online role-playing games (MMORPG).

I. INTRODUCTION

The use of educational computer games in teaching has received significant attention for increasing motivation and for enabling other types of learning experiences than those offered by traditional teaching methods. Despite the fact that this approach is mainly used in the area of lower education [1], more often higher education and universities adopt similar teaching methodologies [2]. In designing any learning game, it is all too tempting to simply graft academic content onto existing forms. While this approach may work, many believe that in any academic discipline, there are elements that are fundamentally game-like. An educational game should put players in touch with what is fundamentally engaging about the subject, should help them build a scaffolding of core concepts, and should motivate them to go deeper. One of the potential roles of video games in education is recognized as effective learning paradigms [3]. Research is needed to advance games for learning. These research need to determine how a) to design learning games to deliver positive learning outcomes, b) to develop tools to automate the process of developing games for learning, and c) to propose methods and techniques to assess the knowledge and skills learners acquire from educational games. This paper addresses the above research problems, providing a novel educational computer game design based on the characteristics and the features of a role playing game.

II. PROPOSED APPROACH

In our approach, we are reusing ideas from MMORPGs inheriting all the available multimodal user interfaces combined with techniques used to increase the students' motivation and the learning outcome. In this section, we give an overview of the three main design areas of an online Virtual University.

A. The University: In the virtual community, each university would be responsible for designing facilities (e.g. virtual labs, virtual campus etc). These facilities would be utilized either by the employed lecturers or they may be rented by other educational institutes.

B. The Lecturers: Each lecturer, creating an avatar, would be locating in the campus supplied by the affiliated virtual university. The avatar would be able to provide a set of 'quests' e.g. assignments, exercises and tutorials that may or may not require the use of the available virtual labs. For example, a lecturer teaching electronics may provide an exercise to implement a circuit using the virtual electronics lab and so on. The second responsibility of a lecturer would be to correct and mark assignments that have been designed by lecturers over the entire virtual academic community of the same field assuming that marking instructions would be provided by the assignment's original creator. The marking procedure would be similar to the one used in conferences.

C. The Students The first time a student logs into the system would be asked to create an avatar, confirm his affiliation and select a path ('race') e.g. medicine, computing, etc from the list provided by the university. Then a course ('class') would be chosen and the student would be ready to join the virtual university. Based on their path and course students would have access to a set of assignments, virtual tutorials either from their university or other institutes if collaboration has been established. A variety of assignments would be available (e.g. for one person, a group, with or without time limits etc) providing at the same time several options. When the students complete the coursework they return it to the lecturer's avatar from where they initially obtained it, ranking also the quality of the assignment, the available tutorials and the virtual facilities. The coursework would be automatically transferred to more than one randomly selected lecturers from any university for marking. According to their marks students gain points and move to the next level having access to more advance exercises ('quests'), facilities and tutorials.

III. CONCLUSION

In this paper we propose a design for a virtual academic community based on the principles and the characteristics of a role playing game. The proposed design would provide lessons that can be practiced repeatedly until mastered, monitoring learner progress, closing the gap between what is learned and its use, and clear goals. In addition, the proposed video game design may develop higher order thinking skills such as problem solving, strategic thinking, analysis, planning and executing, team working and multi-tasking.

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Session: 04D Area 4: e-Assessment and new Assessment Theories and Methodologies - Methods

Online assessment of practical knowledge in electronics laboratory

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An integrated system as a tool for complex technology learning

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Experiments in evaluation: towards an eXtreme Learning method

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Mixed e-Assessment: an application of the student-generated questions technique

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Online Assessment of Practical Knowledge in Electronics Laboratory

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SUMMARY

Thousands of students are graduated with a bachelor degree in Engineering/Technology from universities worldwide every year. Increasing globalization make engineers work or apply for master studies anywhere in the world. There are a wide range of universities worldwide where many of the students attain the same qualification at the end of their course but their technical skill might not be equal. This motivates to establish a common knowledge level for all electronic bachelor degrees worldwide. At Present for assessing the student's knowledge for master studies many universities consider GRE, GMAT, and TOEFL/IELTS. GRE General Test which is considered as an admission criteria for many Engineering courses in some of the developed countries analyzes student's verbal and quantitative ability. GRE General Test has nothing to do with the students Engineering discipline or his technical competence in his field of study. The score in this test is based on high English vocabulary and math.

The concept of evaluating skills of individuals from different countries and providing opportunities based on their knowledge exists since long time and now is the time to extend it to the electronics engineers. A certifying test in electronics laboratory has very high importance as it does not contain theory or a multiple choice question like many other examinations. Here the test takers would be tested in their knowledge with practical equipment. The test taker can clear this exam if and only if he has sound knowledge in using the laboratory equipment. In the exam proposed in this paper there are three levels of knowledge testing, Basic, Advanced and Professional. The test takers are examined using the latest remote labs such as VISIR, iLabs, VELO, REL, WebLab Deutso [1] such that they will be well trained to operate the instruments of similar type and environment which are present in the industry. This exam can be implemented by the engineering associations such as IAOE "The International Association of Online Engineering" and IEEE "Institute of Electrical & Electronics Engineers" combined together formulate syllabus for different levels of certification. Depending on the qualification of the test taker as electronics engineer the level of certification is assigned (for instance

bachelor or master etc.) The syllabus in general is the course curriculum the student has studied for attaining the degree.

For E-Lab professionals each certification level signifies a benchmark of experience and expertise recognized with the electronics industry. The proposed certification exam validates the ability of the test taker to install, configure, operate, and troubleshoot with the electronic equipment, including implementation and verification of connections to various electronic components [2]. Earning certification adds credibility to test takers expertise in using the electronic equipment. For organizations and hiring managers, certification can be a credible prerequisite to identify the expertise for hiring, promoting, and outsourcing decisions. This test certifies that that the test taker is technically competent to handle with the electronic instruments so as to promote sustainable society. This proposed test brings valuable knowledge outcome from the students, rewards to electronic professionals and the companies employing them, the universities admitting them and Research oriented institutes to access the applicant's knowledge in the area of Electronic design and implementation. The fruit of knowledge grading through individual subject related examinations which is presently enjoyed by many software companies should not be limited to their industry itself but to be extended to other core fields such as electronics, mechanics, chemical, electrical, etc. This test enhances skills of electronic professionals which is a benefit for both the employee and employer. Through this paper the authors try to get it to the notice of the engineering organization worldwide that the time has come to develop qualitative engineers and to promote sustainability.

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An Integrated System as a tool for complex technologies learning

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Abstract—This paper describes a computer-based integrated learning system improving engineering teaching and learning of complex technologies. It combines a tutorial with a virtual laboratory and a self assessment tool to achieve a self-learning system.

Keywords—component; integrated learning system; computer aided learning; virtual laboratory; self assessment tool;

SUMMARY

Engineering teaching and learning has turned very difficult because present technological solutions including many interrelated concepts tend to become very complex [1]. Consequently some engineering education experts [2] claim that it is necessary to develop new education methods using information technology tools to improve teaching and learning.

This paper describes a computer-based integrated learning system improving engineering teaching and learning of complex technologies. It combines a tutorial with a virtual laboratory and a self assessment tool to achieve a self-learning system.

The tutorial is a hypermedia learning system structured into chapters, sections and subsections. The different subsections are associated with one or more virtual experiments through a user-friendly graphic interface and some interactive simulated instruments relating practical outcomes with theoretical concepts. The student can execute each experiment at the point indicated in the tutorial after studying the corresponding theoretical concept.

The virtual laboratory comprises a set of virtual experiments. Each experiment is a pedagogical interactive simulation using just a few computer resources and can be integrated with some other software application.

The self assessment tool is a computer tool combining one or more tests with each experiment of the virtual laboratory. In each case the student selects what he thinks is the correct answer and the system does not provide the solution but shows him the experiment outcomes, giving the possibility of verifying his answer. In this way he can learn from his mistakes.

As an example an “Electronics Integrated Learning System” has been developed including a virtual laboratory and a self assessment tool.

The integrated learning system described in this paper is an enhanced active learning rich environment increasing the self learning capacity of students. The virtual laboratory is structured as a set of learning objects and it can be combined with different tutorials. The self assessment tool can also be integrated with some interactive learning management system, such as for example Moodle.

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Experiments in evaluation: towards an eXtreme Learning

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Abstract— In the last years, the field of education has advanced in most of the activities that compose this discipline, boosted by the introduction of information technologies: information gathering, cooperative learning, distance education, administrative processes, etc. However, these advances have been in a lesser extent in the support of evaluation and assessment of students' learning, even when the improvements in evaluation would enhance the whole learning process.

Keywords: e-Assessment, educational methods

SUMMARY (HEADING 1)

In this paper, the processes involved in assessment in engineering university learning are identified, described, reviewed and analyzed in order to ensure fast feedback to the students. A method for evaluation is introduced (eXtreme Learning), which builds up on highly granular and continuous evaluation, integration of evaluation within the general learning process and fast feedback of evaluation results to students. At the same time, the method keeps some principles of traditional learning considered mandatory for its application in university education, as they certify the level of knowledge of the student.

The method relies on the application of well-known principles of pedagogy, such as choosing the proper granularity for each learning activity in contents and students' effort, ordering the knowledge acquisition following a logical path, enforcing the gathering of key knowledge, putting the knowledge into practice (particularly adapted to engineering education), evaluating the core concepts, converting the evaluation into a learning experience, and performing additive marking.

Also, the role of e-learning technology is discussed, as the method, having a cornerstone on fast evaluation, cannot be applied without the proper technical support. In contrast to other approaches, the technical infrastructure plays a secondary role and the required functions can be easily built using widely available software components and services.

This article describes the results obtained in the adaptation of such a method and its application for a first course in computer programming in engineering syllabus, which imposes additional requirements as students must face different studying conditions and context, but keeping at the same time the motivation for the kind of studies they have chosen (thus avoiding the retention problem). The application of the method has been maturing for a number of years as the selection of the proper granularity and sequence of learning contents was guided by a “try and error” strategy. Then, we applied the method in the computer programming in the first course of Telecommunication Engineering in Universidad Politécnica de Madrid, for two different semesters, over a large set of students on a real setting. The control group exhibited better levels of success (percentage pass/total of students) and better learning results (marks over the whole subject) in the two semesters.

Outcomes from the experiences provide hints about the usefulness of the approach. Also the potential problems and drawbacks in the application of the approach are discussed.

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Mixed e-Assessment: an application of the student-generated questions technique

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Abstract—This paper presents the experiment of a mixed summative-formative evaluation in an asynchronous distance higher education context. In the experiment, performed in the distance course of Total Quality Management, Industrial Engineering, University of Guadalajara (Mexico), students are guided to formulate questions on specific topics. Student-generated questions are evaluated through an ad-hoc quantitative tool, specifically designed for the purpose: the four-criterion Observation Matrix. The experiment shows: (1) that it is possible to improve the Higher Education evaluation process and formalise students' skill in a more thoroughly way than with traditional evaluation; (2) how the student-educator interaction in a distance learning environment can be enriched through the mixed assessment

Keywords: mixed formative-summative assessment; distance learning; continuous improvement in higher education; quantitative assessment tool

I. INTRODUCTION

In the first part of this section we identify the role of student questioning as a strategy to promote higher-order thinking and to improve learning. [1]-[2]. In the second part we briefly discuss the result from the recent previous applications of the technique [3], [4]. Finally we present the student-generated questions experience at University of Guadalajara, Mexico. To the authors' knowledge, it is reasonable to consider this experiment the first attempt to evaluate student-generated questions through a distance learning platform.

II. DESIGN OF THE EXPERIMENT

In this section we present how the mixed reverse-question evaluation was developed through a referenced technique for designing and executing examination processes: the Four Processes Architecture [5]. This framework consists of four phases, each of which defines a specific process within the examination, from the learning outcomes selection to the final evaluation of examinees. More specifically, we detail how students are guided to formulate questions on specific topics, and how such questions are evaluated through a novel mixed-assessment tool: the observation matrix [4].

III. EVALUATION CRITERIA

In this section we detail how the student-generated questions are evaluated. After a review of previous works [6] and [7], we detail the criteria adopted in the experiment, namely the four-criterion PTLM (Pertinence, Terminology, Level, Multidisciplinarity) framework. Student-generated questions are evaluated according to four criteria by assigning a binary value for each. It is specified, through a mathematical formulation, how each value contributes to the final score.

IV. RESULTS AND DISCUSSION

In this section the numerical values resulting from the experiment are reported in Figures and Tables. We contrast the average grade obtained by students in the traditional examination and the result of the experiment. Finally, we discuss both the quantitative tool proposed for assessing the students' questions and the method itself.

V. CONCLUSIONS AND FUTURE RESEARCH

It is discussed how the student-educator interaction can be significantly increased through the mixed reverse-question evaluation method and how the distance learning environment can be significantly enriched through the mixed assessment.

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Session: 04E Area 1: Computer Supported Collaborative Learning - Proposals and Methodologies

Experiences in using a MUVE for enhancing motivation in engineering

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A Student-Centered Collaborative Learning Environment for Developing Communication Skills in Engineering Education

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Trends of Use of Technology in Engineering Education

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Ranking Learner Collaboration according to their Interactions

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Experiences in using a MUVE for enhancing motivation in engineering education

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Abstract— NUCLEO is an ongoing research project that aims at developing a MUVE (Multi-User Virtual Environment) platform for collaborative learning, which uses a role game and a virtual fantasy world to stage a problem-based collaborative learning strategy. The project has four main objectives: (1) to stimulate a change of attitude among students towards studying, forcing them to change their passive listener role to a more active role; (2) to increase students' motivation by adjusting the visual features and the interface of the environment to the peculiarities in the way members of the net generation interact with contents and process them; (3) to help to develop communication skills, teamwork abilities and soft skills in our students, while at the same time they acquire the knowledge and technical abilities included in the subject curriculum; (4) to integrate the platform into an e-learning management system application as a way of centralizing the data management, while at the same time offering the chance to combine it with the use of other instructional strategies that can be applied to wider contexts. This paper introduces the reference framework under which the NUCLEO system has been developed, along with the specific model designed to fulfil the objectives mentioned above.

Keywords- Computer supported collaborative learning, Virtual Learning environments, Problem Based Learning.

SUMMARY

Traditional learning strategies are generally based on the revision of contents carefully structured by the teacher and on solving series of exercises organized by themes following an increasing level of difficulty. Also, they usually rely heavily on textual static content with few interactive features. Several analysts sustain the hypothesis that young people today are reluctant to focus their attention on this sort of content format, because of the way the process and interaction with contents has been deeply affected by their everyday exposure to multimedia and ICT devices.

These factors, along with several other related problems, such as, for instance, increasing dropout rates at all education levels, have led the educational community to try new ways of learning, particularly those that seem closer to the aesthetics and the high level of interactivity the net generation seems to prefer, such as educational videogames.

In this paper we present the NUCLEO e-learning project, that has been under development and testing during the last three years in actual academic learning courses in the Electrical Engineering Faculty at the University Complutense of Madrid. It contributes to the research of new ways of learning in the following aspects:

- It seeks to promote a change of attitude among young learners in such a way that they have to abandon the passive role they play throughout their training.
- We look for an effective learning process targeted to achieving specific curricular objectives, and designed to be attractive to the current generation, as well as increasing motivation by applying the formats and interaction modes the “digital natives” prefer, and reaching a compromise between learning and amusement which reasonably satisfies both parts implied (teachers and students).
- It promotes the development of team work, leadership abilities, and communication skills in the students. Traditional learning strategies are mainly focused on developing students' technical abilities and knowledge acquisition, while today's job market demands a wider range of personal abilities, among which those related with handling work coordination within a team are specially valuable.
- It achieves integration into an LMS, on the idea that the tools developed under the proposed reference framework can be complementarily used with other learning strategies, designed and managed through an LMS. Therefore we obtain a twofold benefit: we increase cost effectiveness, on one side, and we increase the pedagogical range and the target audience of the application on the other side.

A Student-Centered Collaborative Learning Environment for Developing Communication Skills in Engineering Education

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Abstract— An integrated student-centered collaborative learning environment for developing communication skills is proposed. This learning environment uses project-based learning methods and peer assessment. By combining a wiki-editing tool and poster presentations, it is intended to facilitate students (1) to gain access to the project of their peers and share their results, (2) to analyze and comment critically the project of their peers and provide them with feedback, and (3) to enhance their writing and oral skills. Preliminary results from previous experiences are presented. It is concluded that the combination of wiki entries and poster sessions can help to develop the communication skills of engineering students.

Keywords- communication skills; collaborative learning; wiki; poster session; project based learning.

SUMMARY

In this paper we propose an integrated student-centered collaborative learning environment for developing communication skills. We adopt a constructivist approach according to which, the best way of learning is by constructing knowledge. The main ingredients of our learning environment are project-based methodologies and peer-assessment, and we propose two strategies to put our method into practice. The first one is a wiki environment, and it is used to document projects, enhance writing skills and facilitate content sharing, reflection, discussion, inter-group communication, and critical thinking and analyzing. The second one is a public presentation based on poster session, and allows us to enhance oral skills, promote participation, inter-group communication, and critical thinking and analyzing.

For the past two years in our department, we have implemented in three courses a wiki environment using the free and open web-based software MediaWiki [1], and we have put into practice the experience with a poster session in another course. Results have been overall very positive and have encouraged us to propose this integrated learning environment. In the first course that implemented a wiki environment students were organized in small groups that were assigned a project that was documented in the wiki.

Students considered that the process of elaborating a wiki had been very positive and confirmed that the wiki approach had allowed them to learn about other projects. Additionally, students said that the visibility of their projects had been a stimulus to increase the quality of their projects. In summary, they benefited from sharing their projects and they were encouraged to be more critical about their work and their peers'. In the second course that implemented a wiki environment, we enhanced the role of the teacher in coordinating the wiki environment. A common standard for entries elaboration was outlined, the uses of the wiki were discussed and two deadlines were established for improving the entries and commenting on the entries of their peers. Compared to the first initiative, a noticeable increase in the quality of the wiki was observed, which we attribute to the efforts to clarify the uses of our wiki. Furthermore, the first deadline gave them the chance to reflect on their own work. Additionally, students commented critically their peers' work, and they said that the comments on their projects would definitely allow them to increase their quality.

In a third course, students were organized in small groups and they were assigned one project that was presented in a poster session. During a time period of two hours and a half, teachers approached each group to evaluate their project. During evaluation, it was necessary that both members be there to explain their project and answer various questions. Meanwhile, in the rest of the groups one member had to stay at their stand to discuss their projects with their peers. Compared to classical presentations, students commented that the discussions that originated were open and lively.

The combination of wiki entries and poster sessions can help to develop the communication skills of engineering students.

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Trends of Use of Technology in Engineering Education

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Abstract—This paper analyses new trends on the use of technology in engineering education having as main source the Horizon Report. We discuss and analyse the predictions of this source and other different views of the current situation of the use of technology based in the previous foreseens and the experience in distance, on-line and on-class engineering education.

Keywords: *Technology enhanced learning; engineering education; service-oriented learning.*

ABSTRACT

Everyday technology is having a more important role inside the engineering education as new technologies are part of the day-to-day learning. And those technologies are implied in the learning process everywhere and in every different learning model (in the traditional on-class system as well as in on-line or in distance models that have everyday more in common in their evolution).

In the last 10 years we had an impressive new use of technologies inside the learning process as well as communication and Internet technologies impact previously in the last part of the 20th century [1]. The Horizon Report [2] has been foreseeing since 2004 the impact of the technologies inside the learning process along the world having three short-term temporary scopes: the year of the report, the next two years and finally, two years more (in the frame of three-to four years from the study).

We will use these predictions from 2004 to 2009 (six Horizon reports) that will cover the period 2004-2013 to analyze the technologies that will have a higher impact in the education. Basically these technologies are Mobile devices (thanks to new interfaces, location-awareness, broadband connectivity, etc.); Cloud computing (use of educative services on the cloud); Geo-everything (mainly related to mobile devices); Personal web (reorganization and customization of the web); Semantic-aware applications (understanding of the meaning of the web content); and Smart objects (the Internet of Things within the education environment. It involves technologies such as RFID, QR codes, NFC or smartcards).

We will also discuss about the technologies not covered in the report and that we believe will also have a great impact in the engineering learning near future, as for example:

Augmented reality (additional information to the real world with interactive features); Social networking (enhancing collaboration through moving the social phenomenon to education); Service-oriented applications integrated in Learning Management System (as assessment solutions, weblogs, etc.) and Video-games (both on desktop or mobile computers, helping learners to be immersed in a virtual world that offer them a deeper understanding of the concepts). In this process we will keep in mind the expertise from previous engineering technology projects [3, 4, 5] as well as the knowledge shared in different technical conferences [6, 7, 8] that provides a guide of the most used technologies around the class-rooms.

With all this information together we will develop an structured view of the foreseen technologies that will have an active role inside the engineering education process, providing our agreement or not with these predictions. On the other hand, the study will include the not foreseen technologies in the past that have been really used in the practice today. Finally we will analyze the technologies that in this moment and in a near future could have a great impact in our engineering education.

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Ranking Learner Collaboration according to their Interactions

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Abstract— Collaboration is supposed to be easily implemented in Learning management systems (LMS). Usually the basic functionalities in that respect support grouping students and providing communication features so that they are able to communicate with each other. However, related collaborative learning and CSCL studies and developments, which have been investigating how to manage, promote, analyze and evaluate collaborative features for decades conclude that there is no easy way, and much less standards-based approaches to support effective collaboration. The mere use of a typical set of communication services (such as forums, chat, etc.) does not guarantee collaborative learning. Further, managing collaborative settings in those LMS approaches is usually a time consuming task, especially considering that a frequent and regular analysis of the group's collaboration process is advisable when following and managing the collaborative processes. To improve collaborative learning in those situations we provide tutors and learners with timely information on learners' collaboration in a domain independent way so that the model can be transferred to other domains and educational environments. After setting a collaborative experience in an open and standards-based LMS, we have analyzed, through various data mining techniques, the learners' interaction in forums during three consecutive academic years. From that analysis we have built a metric with statistical indicators to rank learners' according to their collaboration. We have shown that this rank helps learners and tutors to evaluate the collaborative work and identify possible problems as they arise.

Keywords- Collaboration, Data Mining, Distance Education Learners

SUMMARY

The current web-based Information and Communication technologies (ICT) bring people closer together. In particular, Learning Management System (LMS) use the ICT's so that learners can interact with educational contents and other learners. Collaborative strategy can be implemented in those LMSs to improve the learning and mitigates the typical conditioning factors (loss of communication quality with fellow students and teachers) of the distance education. However, collaboration so widely used and useful in educational environments has not been deeply researched and a standard method to analyze collaboration has not been

established. Although some research works have focused on collaboration, the proposed methods are difficult to transfer to other educational environments.

In this paper we propose an approach to rank learners' collaboration according to their interactions. The objective is to help learners to improve the collaboration process through a method that both provides information on learners' collaboration, and can be used in others LMSs.

To cover the objectives, we proposed an approach based on quantitative analysis of the learner interactions in forums. Forums are a very common service in a collaborative environment and the statistics from forums can be obtained just after the interaction has occurred. We propose building a metric with statistical indicators, which are related to learner's collaboration. First we suggest some statistical indicators, which describe the initiative, activity, learner constancy and activity caused by learners. As the relation between statistical indicators and collaboration is unknown, we have used machine learning algorithms to reveal the relation. After the machine learning analysis, we found that the most collaborative learners are learners with high and constant initiative, high and constant activity, and they caused more activity than others. After the machine learning algorithms had selected the statistical indicators, we built a metric to rank learners according to their collaboration.

The experimentation carried out with over 300 students during three consecutive years has shown that the metric proposed establishes a mathematical relation with collaboration. Therefore, learners can be ranked automatically according to their collaboration while they are in the collaboration process. This metric can be used during the collaboration process in all LMSs or collaborative environments that use forums as the main communication mean. Moreover in terms of the metric the method informs regularity and frequently about the learners' collaboration, which is needed to ensure that the collaborative learning happens and gives information on metacognitive characteristics related to their collaboration, which helps learners to improve the collaboration process, and from that it is expected to affect positively their learning process.

Session: 04F Area 3: Degree Programs and Curricula

The New Degree in Materials Engineering at the Technical University of Madrid (UPM)

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Use of Advanced Technologies in a RF and Microwave Engineering Course

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Internet-based Performance-centered Learning Environment for Curriculum Support (IPLECS) and its application in mLearning

Castro-Gil, Manuel Alonso;Díaz, Gabriel;Kicken, Wendy;Martín, Sergio;Martínez-Mediano, Catalina;Mileva, Nevena;Riopérez, Nuria;San-Cristobal-Ruiz, Elio;Stoyanov, Slavi;Tzanova, Slavka
University of Plovdiv (Bulgaria);University of Sofia (Bulgaria);Open University (Netherlands, The);Spanish University for Distance Education-UNED (Spain)

Natural Sciences in the Information Society - First Experiences

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The New Degree in Materials Engineering at the Technical University of Madrid (UPM)

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Abstract— The Technical University of Madrid (UPM) is pioneering the introduction in Spain of a new Degree in Materials Engineering, with a four-year duration, accessed directly from the baccalaureate-level studies. The materials engineers from the UPM will be prepared to meet the challenges not only in the field of structural materials, but also in functional materials and biomaterials. With the objective of enhancing student exchange programmes, the third year of studies will be taught entirely in English.

Keywords: Materials Engineering, Degree Programmes

SUMMARY

Materials engineering is an interdisciplinary field that studies the relationship among the structure of materials at atomic or molecular scales, their macroscopic properties, their processing and their applications. The field of materials engineering began to be considered as a discipline in itself around the mid-1960s. At first, many materials science departments were named metallurgy departments and focussed their research and teaching on metals. In the 21st century, the field of materials engineering has been broadened to include every type of materials, including ceramics, polymers, semiconductors, magnetic materials, medical implant and biological materials.

The study of materials engineering has for many decades been established across the economically-developed world. However, in comparison with other developed countries, in Spain the materials engineering degree course is a relatively recent programme. The UPM was the first institution to introduce an upper-level degree in the field in 1995 [1]. With the arrival of the Bologna Process and reform and adaptation of higher education in Europe, in Spain the UPM is once again a pioneer institution in the introduction of a new post-baccalaureate, four-year degree course [2] in materials engineering.

The degree programme is measured in accordance with the credits awarded by the new European Credit Transfer and Accumulation System (ECTS). Considering one ECTS credit to involve 25-30 hours of study, the new Degree in Materials Engineering will entail 240 such credits, structured over four academic years (eight semesters) of 60 credits each one (30 credits per semester). Under such a structure a final-year

dissertation or end-of-degree project (equivalent to 12 credits) will be undertaken.

The course involves a forward-looking curriculum in which students acquire knowledge of the three main branches of the field of materials: traditional structural materials, but also functional materials (semiconducting, dielectric, optical conducting and magnetic materials used to create integrated circuits, storage media, sensors and other devices) and biomaterials (materials that interact with biological systems; materials of biological origin; and biomimetics) [2].

General (or transversal) skills (IT, communication and interpersonal and English language skills) are considered fundamental, and will be taught and graded in a horizontal manner, shared between all the subjects.

One of the primary objectives of the European Higher Education Area (EHEA) is to open education systems to free movement of students. In this sense, a primary objective considered for the new degree has been that of enhancing student exchange programmes with other European higher education institutions. The third and fourth years of the new Degree have been open to exchange programmes, and specially important is that the third year will be taught entirely in English.

New materials have played an essential part in providing technology needed for scientific development, which has in turn brought great benefits to society. For this reason, empowering students in materials science and engineering is one of the paramount long-term investments that can be made in the technological future of a nation.

The first lectures of the new Degree in Materials Engineering at the UPM commenced in September of the academic year 2009-10, with the course being 100% subscribed.

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Natural Sciences in the Information Society

First Experiences

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Abstract— **The goal of the GALILEA project is to design and implement innovative programs and curricula, providing solutions to the changed job specifications for engineers and natural scientists and are capable of attracting more female students to these programs. In this article we outline the design, implementation and the first evaluation results of our pilot program, the bachelor course of “Natural Sciences in the Information Society” that started in the winter term of 2007/08.**

Keywords *engineering education; natural sciences, gender studies*

SUMMARY AND FUTURE WORK

Especially the German industry needs more qualified engineers and natural scientists at this point in time. The number of students currently enrolled in the corresponding programs is too small to fill this gap. While more female students could stand in, the majority of these programs are rather unattractive to women. In particular, many students in these fields are not well prepared for their future professional life. Important soft skills or communications skills are needed. Numerous evaluations, e.g. [1], prove that the quota of women in the programs mentioned is considerably increased by special adaption to their needs (e.g. multidisciplinary). However, this can only be achieved if the curricula are readjusted. Moreover this can also motivate numerous male students. The awareness in Germany to readjust courses of studies is developing very slowly, yet constantly growing. In addition, there are many efforts to encourage female students. Thus, female students will be supported from kindergarten onward all the way to studies at the university level through scholarship programs. However, the criticism grows that many male students are now facing disadvantages due to the changing gender stereotype settings and activities [2]. Therefore a lot of male school graduates would not continue to university any longer and would also not come into consideration for a qualified profession. At TU Berlin these challenges are well-known, and different solutions are being sought out. TU Berlin strives to be a forerunner for new challenges in research, economics, and society, in order to achieve a new image of engineering and natural sciences. One of these approaches is the GALILEA project. GALILEA is designing programs in order to increase the quota of women in engineering and natural sciences by integrating specific female

requirements and new educational paradigms. Through the Bologna declaration [3] the incentives for completely new programs are provided since the two-tier bachelor and master system is a completely new structure in the academic education in Germany. Therefore, the GALILEA project designed the program “Natural Sciences in the Information Society” aiming at a quota of about 50% female students. This new approach is integrated not only into the concept of the entire program but also through the individual lectures “*Scientific Information Management*” and “*New Media in Teaching and Research*”. These two lectures for the Bachelor program were evaluated. Generally, the lectures were positively assessed. During the first run of these lectures students identified some technical procedures such as high expenditure of work or too many examined topics to be disadvantageous. The multidisciplinary approach was assessed as good, and the students had the feeling that the lectures impart soft skills that can be useful in further studies or future jobs. In addition to the curriculum a mentoring program is integrated into the GALILEA program, accompanying students throughout their studies. An evaluation of the mentoring program took place as well. The biggest issue found was that the meaning of the notion “mentoring” is not universally understood, in spite of efforts of explanations in training courses. Students are already aware of the existence of a contact person, but this offer is accepted mainly in the first term. Even so the program was evaluated positively. A good approach was to enlist sophomore students as mentors for their freshmen fellow students. The developing relationships are considered amicable and lasting. In further evaluations, we would like to examine specific problems within the lectures and the mentoring program to improve our courses.

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Internet-based Performance-centered Learning Environment for Curriculum Support (IPLECS) and its application in mLearning

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Abstract— IPLECS is a virtual campus platform for the development of performance-centered reusable learning materials, and its application in mLearning for educational and training purposes. The combination of performance support systems and mobile devices present both opportunities and challenges for work-based learning design.

Keywords- *Internet-based learning; Performance-centered learning, curriculum development.; Engineering Education.*

SUMMARY

We present two Project financed by Socrates Agency. One for the curriculum development of one Master in Information and Communication Systems between seven European Universities, and the other for the development of mobile learning.

IPLECS is a virtual campus platform for the development of performance-centered reusable learning materials, their composition and organization in performance-centered settings and their usage to support university curriculum in the field of physic-engineering education. IPSS_EE is an integrated electronic environment, which is available via Internet and is structured to provide individualized online access to the full range of information, guidance, advice, data, images, tools and software to permit the user to perform a task with a minimum of support and intervention by others. The system has elements of performance system, elements of traditional Web-based educational program and automatic test system. The system uses a new technology for improving students' competency and performance by providing support for processing, analysis and reflection on information and learning experience.

Learning materials in IPLECS take the format of "learning objects" (LOs), specific for the performance-centered approach and presentation. We present the conceptual model and description of so called IPSS_EE LOs and extend the IEEE LOM. Model and description of IPSS_EE LOs are useful for understanding their features, for enabling their publishing in a Web context and for enabling their reuse across different learning sessions. Learning materials to support a complete integrated program, developed and use in a virtual performance-based learning environment will be developed. In the whole process, various competences and innovative and consolidated information and communication technologies will be used.

The main reason of the application of Performance centered Approach in mLearning for educational and training purposes is to contribute to the continued development of mobile learning and to address the imbalance between the availability of mobile devices and the lack of education and training provision on the sophisticated communications devices which every student and actively working person carries and uses constantly – except in education. The advantages for trainees are derived from providing learners with a job aid in the context of their work. Given the trend to lifelong learning, many “students” are working adults with full-or part-time jobs. Mobility offers them an opportunity to maximize learning time.

Mobile devices are always available and can be used for a variety of learning functionality - providing access to content (both informational and instructional) and for communication and collaboration purposes. They can be used for formal or informal learning purposes as well as for performance support, i.e. for delivering information and support just-in-time and in context.

The IPLECS and mPSS Projects aim: Design, composition and reuse of IPSS_EE LOs and experiment the usage of the learning platform and of IPSS_EE LOs for the physic engineering integrated curriculum support.

The IPLECS workflow for curriculum development is based in: 1) State a reference situation in which the students will use what they will going to learn, 2) Formulate a few Learning goals and clear and specific objectives competences oriented, 3) Create learning tasks with performance support, to provide to the students: Background information, Examples, Procedures and Feedback, in order to help them perform the task more easily and facilitate learning.

The projects objectives are linked directly to support the realization of a European Higher Education Area, support the development of innovative ICT-based content, and provision open educational resources on-line, testing innovative performance-based e-learning and to contribute to the development of mobile learning in education

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Natural Sciences in the Information Society

First Experiences

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Abstract— The goal of the GALILEA project is to design and implement innovative programs and curricula, providing solutions to the changed job specifications for engineers and natural scientists and are capable of attracting more female students to these programs. In this article we outline the design, implementation and the first evaluation results of our pilot program, the bachelor course of “Natural Sciences in the Information Society” that started in the winter term of 2007/08.

Keywords engineering education; natural sciences, gender studies

SUMMARY AND FUTURE WORK

Especially the German industry needs more qualified engineers and natural scientists at this point in time. The number of students currently enrolled in the corresponding programs is too small to fill this gap. While more female students could stand in, the majority of these programs are rather unattractive to women. In particular, many students in these fields are not well prepared for their future professional life. Important soft skills or communications skills are needed. Numerous evaluations, e.g. [1], prove that the quota of women in the programs mentioned is considerably increased by special adaption to their needs (e.g. multidisciplinary). However, this can only be achieved if the curricula are readjusted. Moreover this can also motivate numerous male students. The awareness in Germany to readjust courses of studies is developing very slowly, yet constantly growing. In addition, there are many efforts to encourage female students. Thus, female students will be supported from kindergarten onward all the way to studies at the university level through scholarship programs. However, the criticism grows that many male students are now facing disadvantages due to the changing gender stereotype settings and activities [2]. Therefore a lot of male school graduates would not continue to university any longer and would also not come into consideration for a qualified profession. At TU Berlin these challenges are well-known, and different solutions are being sought out. TU Berlin strives to be a forerunner for new challenges in research, economics, and society, in order to achieve a new image of engineering and natural sciences. One of these approaches is the GALILEA project. GALILEA is designing programs in order to increase the quota of women in engineering and natural sciences by integrating specific female

requirements and new educational paradigms. Through the Bologna declaration [3] the incentives for completely new programs are provided since the two-tier bachelor and master system is a completely new structure in the academic education in Germany. Therefore, the GALILEA project designed the program “Natural Sciences in the Information Society” aiming at a quota of about 50% female students. This new approach is integrated not only into the concept of the entire program but also through the individual lectures “*Scientific Information Management*” and “*New Media in Teaching and Research*”. These two lectures for the Bachelor program were evaluated. Generally, the lectures were positively assessed. During the first run of these lectures students identified some technical procedures such as high expenditure of work or too many examined topics to be disadvantageous. The multidisciplinary approach was assessed as good, and the students had the feeling that the lectures impart soft skills that can be useful in further studies or future jobs. In addition to the curriculum a mentoring program is integrated into the GALILEA program, accompanying students throughout their studies. An evaluation of the mentoring program took place as well. The biggest issue found was that the meaning of the notion “mentoring” is not universally understood, in spite of efforts of explanations in training courses. Students are already aware of the existence of a contact person, but this offer is accepted mainly in the first term. Even so the program was evaluated positively. A good approach was to enlist sophomore students as mentors for their freshmen fellow students. The developing relationships are considered amicable and lasting. In further evaluations, we would like to examine specific problems within the lectures and the mentoring program to improve our courses.

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Session: 04G Area 5: Gender Issues in Engineering Education

Real Projects to involve undergraduate students in CS degrees

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Who enrolls in electrical engineering? A quantitative analysis of U.S.A. student trajectories

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Achieving and Sustaining Gender Balance in an Undergraduate Teaching Institution

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SPIRIT - A Life-Cycle Based Gender Mainstreaming Concept at the University of Stuttgart

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SUMMARY

Technological advances are improving the standard of living and the working conditions. Curiously, the number of students that choose technological studies and careers continues to decline [1]. This fall is particularly noteworthy for females

One of the main reasons points to the lack of knowledge of the professional profile in the computer science field [2]. Teenagers and undergraduates do not have clear models in their lives (neither real people nor fictional characters). Consequently they do not know the kind of job an IT professional performs, so they do not have the corresponding degrees (Computer Science and Computing Engineering) as a future option for their careers.

A possible solution to this problem is introducing a real project in the curriculum: describing a problem, devising a specific solution and making the implementation in a real platform. There are well-known references and experiences about project-based learning. Research in the area shows that learning is a rich context of experiences, not only based on information, but hands-on, social activities, community discussions, and real problem solving, among others.

Choosing a people-centric project to improve their own community (school, neighborhood, shopping-mall) they will be familiar with the social aspects of their future job. This aspect is a fundamental part of making Computer Science appealing to the new generations.

These project-based classes have also the advantage of allowing the student to develop other professional skills such as leadership, teamwork and decision making analysis.

Similarly, they offer scope to learn and improve technical skills such as modular and parallel programming, event management or testing experiment design, as well as new areas of interest including open source software, low power analysis and mobility.

With this in mind we present a foundation to develop real projects based on a wireless sensor network (WSN) platform and two project proposals presented by undergraduate students.

The choice of the platform and environment used to build the project is as important as determining the objectives and methodology to accomplish all these three goals. This platform should allow for a variety of situations to promote creativity, acquire professional habits and attitudes, and improve their comprehensive in computing among other goals.

In this work, we have chosen a wireless sensor network platform and the activities have been designed jointly with a technological enterprise (DEXMA), which provides professional expertise and advice on the appropriate devices. They are also in charge of introductory seminars.

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Who enrolls in electrical engineering? A quantitative analysis of U.S.A. student trajectories

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Abstract— Electrical Engineering (EE) is one of the largest engineering disciplines. Analysis of the student population specifically within EE provides insights into a large segment of the undergraduate engineering population. Using a dataset from universities in the United States of America that includes over 70,000 students who majored in engineering, this work considers the subset of that population matriculating in EE. The rates of EE matriculation and six-year graduation vary by race and gender. The relevant findings are that males outnumber females at all levels of undergraduate EE. EE is the most popular choice for Asian and Black males at matriculation and the second choice (after ME) for Hispanic and White males. EE is much more popular for Asian and Black females than Hispanic and White females at matriculation and graduation. In fact, more Black females graduate in EE than in any other engineering discipline. The six-year graduation rate of EE matriculants is higher than that of students of other engineering disciplines. These findings suggest the importance of disaggregating by engineering sub-discipline and examining how such information is useful in improving recruitment and retention overall.

Keywords— Electrical Engineering, retention, race, gender

SUMMARY

There have been numerous calls to diversify the engineering profession. Electrical Engineering (EE) is one of the oldest and largest engineering disciplines. Thus analysis of the student population within EE provides insights into a significant segment of the undergraduate engineering population. Despite large enrollments, EE has a very low percentage of women.

Given our extensive dataset, we are able to disaggregate not only by engineering discipline but also by race and gender using a critical race theory framework. This permits an investigation of EE students at an unprecedented scale and detail. In this paper, we examine how the matriculation and six-year graduation patterns of EE matriculants in the U.S.A. vary by both race and gender.

This study uses the Multiple-Institution Database for Investigating Engineering Longitudinal Development, a dataset with more than 79,000 students matriculating in engineering from 1987 to 2004. We focus on first-time-in-college U.S.A.

citizens / permanent residents matriculating directly in an engineering discipline. Since we have whole population data, inference is unnecessary.

Women and men prefer different engineering disciplines at matriculation and graduation. The top two choices of men are Mechanical (ME) and Electrical (EE), yet the order varies by race. At matriculation and graduation, Asians and Blacks prefer EE to ME while Hispanics and Whites prefer ME. For women of all races, Chemical is the top choice at matriculation. EE is the second choice at matriculation for Asian and Black women while ME is the second choice for Hispanic and White women. By graduation, IE is the most popular major for Hispanic and White women, Asian women still prefer Chemical, and Black women prefer EE.

Men of each racial group are more likely than women to matriculate in EE. Of all racial groups, Black students choose EE at matriculation at the highest percentages of all subpopulations. Of Black men who matriculate in engineering, 30% choose EE, the highest of any group. The second highest percentage is 24% for Asian males. EE attracts 21% of Black women in engineering, the highest of any group of women with the second highest being 14% of Asian women.

More men of each race also graduate within six years in EE than women. The percentage of EE matriculants who graduate within six years in EE varies by race and gender from a low of 30% for Hispanic women to a high of 57% for Asian women. Asian and Black women EE matriculants graduate in six years in EE at a rate equal to or higher than men of the same ethnic group. Black women graduate at 43% compared to 38% for Black men. White men and women EE matriculants have similar graduation rates. If EE matriculants graduate in an engineering discipline, they are most likely to graduate in EE of any engineering major for all races and genders. By six years from matriculation, fewer than 16% of EE matriculants switch from EE to another engineering major.

Based on these findings, the trajectories of students matriculating in EE are gendered and racialized. This merits further study to better understand EE students and identify potential recruiting opportunities.

This work has been sponsored by a U. S. A. National Science Foundation Gender in Science and Engineering Research collaborative Grant (0734085 and 0734062).

Achieving and Sustaining Gender Balance in an Undergraduate Teaching Institution

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Abstract --- Recruiting and retaining women in the STEM faculty ranks has been a national priority for many years. Recent research, sponsored by the NSF ADVANCE program, was performed mostly by doctoral institutions. However, for small undergraduate universities, the resulting challenges and decision frameworks are likely to be different. The prevalent recommendations need to be re-evaluated and re-interpreted for relevance and applicability. Multiple change agents have been identified, but it is believed that the departmental climate most strongly correlates with successful institutional transformation. The primary success factor is a set of formalized processes in: (1) teaching, scholarship and service, (2) mentoring, and (3) leadership. A secondary factor is a faculty support infrastructure capable of fostering collaborations and reducing isolation. A third factor is an introspective capability that broadens the understanding of the issues affecting women ultimately expressed in the form of better policies and procedures. There is a strong connection between gender progress on the faculty side and improving the pipeline of female students. To effectively intervene on the supply side, it is important to have networking, mentoring and role modeling processes that match student demographics and global sociological conditions. In the case of our University, this requires recruiting, developing and retaining faculty whose principal focus is undergraduate education which is challenging in STEM fields where the traditional emphasis is on research. Curricular evolution in doctoral institutions is typically driven by emerging trends and technological opportunities while the needs of regional industries and local programs are more influential among primarily undergraduate institutions. As advanced degrees become a professional requirement, baccalaureate graduates will be expected to pursue advanced studies early in their career. Hence, more undergraduate STEM programs will serve as feeders to doctoral institutions. The future supply of graduate students and ultimately faculty will become more dependent on these teaching universities. This paper describes our specific efforts

and successes in the context of an undergraduate teaching institution. We have demonstrated that even with limited resources and no external funding, it is possible to improve the community culture and climate. Tangible strategies and initiatives aimed at improving the climate are presented: (1) administrative leadership commitment, (2) grants and endowments, (3) faculty development resources, (4) workshops that mirror industry successes, (5) early and mid-career planning, and (6) recruiting and retention of female faculty. Keywords- gender balance; female faculty; recruiting; student retention

Spirit

University of Stuttgart's Life-Cycle-Based Gender-Mainstreaming-Concept

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Abstract— In spite of social and political efforts to achieve equal opportunities, women remain a minority in natural sciences, technical and related fields. We present the gender concept of the University of Stuttgart.

Keywords—gender concept, female academic education, diversity studies, women in natural sciences and engineering

I. INTRODUCTION

Despite comprehensive social changes and political efforts to achieve equal opportunities women remain a minority in the natural sciences, technical study fields and the corresponding occupational fields. This paper presents the complete gender concept of the University of Stuttgart. First the steps for promotion of female students and women within the natural science and technical fields have to be developed. Female underrepresentation in science and the demand for equality of the sexes have become a vital aspect of the ongoing reform discussions. A special look should be taken at the education-economic perspective as well as the aspect of quality assurance and the capability to be innovative [1]: The underrepresentation of women in scientific and technological fields has technological implications such as design, quality and diversity of products. In fact, creative innovations cannot be “all-inclusive” without the inspiration of women: products might be designed faulty because their usage options were only viewed under considerations of requirements of special groups. The absence of women from certain technological fields poses a hard challenge for industry and economy: the demand of qualified specialists cannot be satisfied by men willing to pursue an academic education [2]. The existing loss of interest by men in technical and engineering subjects intensifies the challenge [3]. Moreover, demographic development in Germany and global competition exaggerate these challenges. Technical disciplines graduates are filling important jobs in our society. These are characterized by fields of responsibility and extensive influence. Technical authorities are a key factor of shaping our society [4]. The underrepresentation of women in these fields is a drawback to an equal participation of women. In fact, there are lots of single initiatives aimed at “breaking down the gender-gap”. Consistency, continuity and transparency are missing due to the lack of a comprehensive strategy. This leads often to a “twofer” for some target groups while other arrangements and initiatives are missing. Communication and information campaigns aimed at reaching a broad group. Creating a common

understanding of requirements are an exception. The objective of universities should be to concentrate and coordinate existing and successful measures: all arrangements result from a coordinated gender master plan that comprises the full life-cycle from kindergarten to professorship with leadership function, whose single steps make a seamless, coordinated transition between different measures possible, and that includes a concept of family-friendly policies for all members of university.

II. SUMMARY

The University of Stuttgart sees the sustainable implementation of gender-justice as an important challenge. The realization of a profound gender concept based on the observation of the complete life cycle with measures for different target groups – schoolgirls, female students and female scientists – will become an attractor for the University of Stuttgart to survive the fight for the best minds – on national and international levels. Within the scope of the overall process the university administration coordinates the existing activities and combines and expands on them. A numerous additional innovative measures are currently being prepared and will be sustained by a financial package containing budgeting, third-party funds, and endowments. The professorships within the female professor program serve as seeds for new impulses and will develop institutional and thus sustainable responsibility for important building blocks of the master plan. The gender mission statement is being created under the leadership of the president including a road map with measures for quality control and operative realization – henceforth gender is given top priority!

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**Session: 05A Area 1: Learning Systems Platforms and Architectures -
Platforms and Learning Tools**

Personalized Construction of Self-Evaluation Tests

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**A Middleware for the Integration of Third-party Learning Tools in SOA-based
Learning Management Systems**

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Principles for the Design of a Remote Laboratory

Cagiltay, Nergiz; Aydin, Elif; Ali Kara
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**Supporting Person-Centered Learning: Does the Choice of the Learning
Management System Matter?**

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Evolutionary Mechanism for E-Learning Platforms - A new approach for old methods

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Personalized Construction of Self-Evaluation Tests

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Abstract—The European Higher Education Area, an agreement by 29 countries to unite and harmonise qualifications and Universities' rapprochement to the real demands of the labour market, will make a significant change in the traditional model of teaching tools to carry out more personalised monitoring of the student's work, leading to the possibility of continuous evaluation. The suitable use of Information and Communication Technologies (ICT) can make a contribution to improving the quality of teaching and learning. In this context, a self-evaluation platform is developed using the technology of Intelligent Agents. This system can be adaptable and adjusts the various self-evaluation tests to the student's level of knowledge. Each student has a profile and, depending on this, timing and interaction is set by the agents.

Keywords- *e-learning; user profile; self-evaluation.*

I. INTRODUCTION

In June 1999, the Education Ministers from 29 European countries met in the Italian city of Bologna to approve the declaration for the convergence process towards the European Higher Education Area (EHEA). 2010 was set as a final deadline to finalize this process. Among other things, it brings new teaching and evaluation models based on the student's continuous work. In this situation, it will be the student himself who is the protagonist of his own learning by using, at the right time and place, the contents and resources provided specifically for him by the lecturer. With this methodology, it is far easier to adapt and personalize teaching to the student's concrete needs and capacities.

Traditional teaching methods measure the student's learning by using objective processes – both written and oral – which cannot evaluate the student's continuous effort and have no clearly formative objective. In this new educational scenario, the student's continuous evaluation and the absence of a teacher are the main axes of the formative process. The lecturer will assist and guide, designing various activities focused on acquiring the desired level of competence. One technique which has formative characteristics is a self evaluation test. However, this type of assessment is not very useful as it cannot adapt to different student profiles. Most software tools built to date which incorporate this type of assessment are not adapted to the student's individual characteristics nor do they allow the extraction of information on student behavior when sitting the assessment.

II. CREATING A STUDENT PROFILE

A student profile could be set up by uniting data which reflects the student's competencies as regards concepts, procedures and aptitudes for a subject. This information, clearly symbolical, could be used to personalize any type of student evaluation assessment, adapting it to the level of acquired knowledge and aptitude.

A computational model of a student's profile which is dynamically adaptable and up-to-date can be set up by evaluating various self evaluation tests and analyzing how this is confronted and how to solve the problem. Taking this into consideration, a student's profile would be made up of two components: (a) a particular component, which is obtained from the student's knowledge and aptitude for a concrete theme; and (b) a general component, which is the calculation of all the particular components of the student profile. The general component of a student's profile measures his general competence in the subject and the particular component measures his level of knowledge and aptitude in each theme.

This model has been embedded in a multi-agent system that uses a host of software agents to manage the self evaluation process, from the moment when the system is accessed, passing through the process of generating the test, to the moment when results are given. A self evaluation tool has been developed whose global architecture is composed of a Web client (an navigator with which the student interacts), a Web server (whereby the agents' platform is situated), and a database. The server collates information generated by interactions of the multi-agent system and database, from agents and from students; it processes it and presents it in the form of dynamic Web pages.

III. CONCLUSIONS

Self evaluation is a process which starts with an assessment in the form of a test and ends with information on errors committed. This type of assessment is beneficial both for the student and lecturer. For the student, allows him to direct his learning. In turn, the lecturer can gather significant information on the degree of satisfaction of the initially set aims.

A self evaluation tool has been developed which allows the student to evaluate his learning process, helping him to check and consolidate his acquired knowledge and motivating him in his search for further knowledge. By using this tool, the student will be able to control, verify and improve learning through the self evaluation tests adapted to his profile and from the feedback generated by the agents once the test is corrected.

A Middleware for the Integration of Third-party Learning Tools in SOA-based Learning Management Systems

Supporting Instance Management and Data Transfer

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Abstract— Learning Management Systems typically provide a centralized environment where students can communicate, carry out experiments, etc. However, the rapid growth of these platforms together with the unlimited need for learning tools, mainly in engineering education contexts (e.g. simulators, communication tools), are hindering their development. The natural alternative is to decouple these tools from the Learning Management Systems themselves, taking advantage of the *Software as a Service* distribution model. To perform such a decoupling a middleware is required to allow the integration and use of an external tool by the Learning Management System. In this paper a proposal for such middleware is described, with a special focus on the part devoted to manage instances and the transfer of data.

Keywords—Data-transfer interface; Hard integration; Instance Interface; Learning Management Systems; Middleware; Software as a Service

SUMMARY

Engineering education is experiencing great changes during the last years by the use of Web-based applications. Learning Management Systems (LMSs) are playing a key role in this scenario. These systems typically facilitate the control of educational activities, providing a centralized environment to organize and provide information, to support the communication between teachers and students, to enable the interchange of documents, to answer online questionnaires, etc. Nevertheless these LMSs are too generic. The “one size doesn't fit all” problem is very notorious here, since their functionalities are generally designed for the support of a general educational approach based on the delivery of contents. Nevertheless, many engineering subjects require not just the delivery of contents, but also the performance of experiments, practical developments and collaborative works among students. During the last years these activities have been supported in several ways by technology-based solutions

developed outside of the LMSs: simulators, remote labs, agent-based environments, games, immersive environments, etc. As a result, a plethora of tools and services is currently required for the support of engineering education e-learning courses, but in general they are not available in LMSs.

The previous problems have been identified as LMSs' tailorability and extensibility deficiencies that need to be solved. Up to date, some solutions have been proposed, but with limited success. For example, Moodle and Blackboard have capabilities to extend their own functionalities: the so-called “extensions” [1]. However, in these systems integration of external tools is considered only a supplement. As a result, it is possible to include a new tool in Moodle or Blackboard, but the integrated tools do not work in coordination with the core LMS.

The tailorability and extensibility deficiencies found in existing LMSs, together with the essential need of extensions, have led us to the conception of a middleware to enhance and facilitate the integration between LMSs and third-party tools. This middleware is based on a *Software as a Service* (SaaS) distribution model that allows the LMS to use third-party tools exposed as Web Services. In this paper we give an overview of the different communication protocols, components and software stacks involved, with a special focus on two key parts of the middleware: the Instance Interface (those elements to create and manage the instances of a third-party tool), and the Data-Transfer Interface (those devoted to transfer data elements between the LMS and the tool). Their development has been based on the study of existing solutions and the application of a rigorous analysis of requirements.

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Principles for the Design of a Remote Laboratory: A Case Study on ERRL

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Abstract— Remote laboratories are getting very popular in engineering education programs. However, there are not many studies addressing the requirements and design issues of such laboratories. This paper discusses the results of a study of the requirements for developing a remote Radio Frequency (RF) laboratory for university students. This study draws on the perspectives of the students at the university, department of electrical engineering. The results are based on a research study established by 111 engineering students from France, Germany, Romania and Turkey. It investigates how students would like to use the technical content of a state of the art RF laboratory. The result of this study is also compared with the previous outcomes showing perspectives of the other learner groups of such laboratories; engineers and technicians in the technical colleges on the Radio Frequency (RF) domain. Considering the outcomes developed so far, some principles that need to be considered while designing and developing such a laboratory have been proposed. As a case study the proposed principles are implemented in a remote laboratory project. In this paper, the details of user requirements of such laboratories, the proposed principles and the implementation examples are all provided and discussed. Primarily, the general aim of this study is to guide remote laboratory platform developers towards the most effective design of their platforms.

Index Terms— higher education, engineering education, remote laboratory, distance education, improving classroom teaching, lifelong learning.

SUMMARY

Nowadays, based on new technologies, educators and curriculum developers are able to provide a wide range of educational alternatives for learners. Remote and virtual laboratory environments are some of these alternatives which have shown that they are potential solutions for supporting current education and providing some alternative solutions for distance learning environments [2]. However, in literature, not many studies discussing the requirements of those laboratories and the instructional design issues that need to be considered in the design of such laboratories could be found. Furthermore, as Koo hang and Durante reports, the web-based distance learning technologies rely on interface design elements such as usability, visualization, functionality and accessibility which play an important role in learning [3]. Accordingly, appropriate learning theories and principles as well as user interface elements need to be considered in the design of such laboratories [3]. In our previous studies, we have discussed the requirements for remote RF laboratory applications from the educators' [2], the technicians' and engineers' [1] perspectives. This paper aims to find out the requirements from the students' perspective which is organized for the European Remote Radio Frequency

Laboratory (ERRL) project¹. How do the students prefer to study in a remote laboratory environment is the basic question of this study. The study is established on potential students of such a laboratory environment: students in higher education institutions. The main scope of this study is limited to the instructional content design issues for such laboratories. The issues that need to be considered in the sense of user interface design of such laboratories are not included in this study.

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¹ Guest access is available at <http://erlmoodle.atilim.edu.tr/> with both user name and password being "visitor"

Supporting Person-Centered Learning: Does the Choice of the Learning Management System Matter?

A case study with Moodle, Fronter and CEWebS

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Abstract—In this contribution the implementation of a person-centered blended-learning-course in Moodle, Fronter and CEWebS is described and analyzed.

Person-centered blended learning; Blended learning; learning management systems;

SUMMARY

One challenge in the successful implementation of a blended learning scenario is the choice of the appropriate tools. A general question behind our practical approach is: “How well do different eLearning solutions provide functionality to realize a blended learning course, which is designed according to specific educational principles?” In our understanding blended learning scenarios should be developed, in the first place, based upon specific learning paradigms and not on what a technological solution can offer. Since we aim to promote person-centered technology enhanced learning [1], [2], [3] we see ourselves confronted with the question: Do current learning management systems sufficiently support person-centered technology enhanced learning-designs?

To approach a response to this question for our case we decided to choose a more experiential procedure. Instead of analyzing the considered learning management systems with the help of a fixed catalogue of criteria (as in [4]), one typical person centered [5] blended learning course was implemented in three different eLearning solutions, namely Moodle, Fronter and CEWebS. The resulting realizations of the course and the necessary actions were documented and are compared in this paper.

The source case course for our endeavor was the course “project management”, conducted in the summer term 2009 at the Faculty of Computer Science of the University of Vienna. The course was about learning the basic concepts in classical and agile management. Central topics were managing IT and interdisciplinary projects, controlling, cost estimation, risk analysis, organizational techniques and conflict management. Students were asked to accomplish single and group assignments. “Project management” had originally been developed for use with CEWebS and, vice versa, CEWebS had

once been originally developed with person centered technology enhanced learning support in mind [6].

The paper will be structured as follows. First we describe the design and goals of our course. Subsequently we briefly introduce the three eLearning solutions that are the subject of the case study. We start with presenting the CEWebS implementation and proceed by discussing the transformations into Moodle and Fronter. Subsequently we confer the effects of our approach, which was the actual realization of one course in three different learning management systems, a documentation of this process and a cased based evaluation of the resulting course implementations.

So far, a successful implementation of a blended learning scenario in correspondence with the pedagogical and didactical principles of a person-centered approach was found to be - in an effective way - dependent on the choice of an appropriate eLearning solution. Furthermore, we found that the knowledge of experts can prove as a time-saving and enriching enhancement to own efforts. To sum it up, although eLearning technologies underwent a rapid development in the last years, the choice of a suitable solution is still an essential step in a successful and effective realization of a person-centered blended learning course.

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Evolutionary Mechanism for E-Learning Platforms

A new approach for old methods

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Abstract—Since the beginning of men, knowledge distinguishes us as a species and has become the key to our own evolution. Humans have a complex psycho-pedagogic model, the result of millions of years of evolution. This model compromises very often the educational structures, because each of us – despite we can be inserted in specific groups, have a personal learning curve. Like nature, that develops special strategies for the evolution of the species, it is possible to find the correct individual learning path, using one of the oldest Mother Nature mechanisms – evolutive genetic. Using tools like JAVA, XML (eXtensible Markup Language), an open source LMS (Learning Management System), i.e. Moodle, a standard as SCORM (Sharable Content Reference Model), all controlled by a GA (Genetic Algorithm), it is possible to achieve a flexible platform to help all the educational process actors. The goal is to create a self universal monitoring and learning system, which follows the progression of individual learning – by using a mathematical function applied to a genetic algorithm, maximizing the results and achieve the subject “learning curve”.

Keywords: Java, XML, SCORM, Genetic Algorithm

Session: 05B Area 3: General Issues in Engineering Education - Improving students performance

Personal Learning Environments in a Global Higher Engineering Education Web 2.0 realm

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Filling the gap of Information Security Management inside ITIL®: proposals for postgraduate students

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Student Motivation and Cross-curricula Development through e-learning applied to cooperation

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Practical Framework of Employability Skills for Engineering Graduate in Malaysia

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A Proposal for the Evaluation of Final Year Projects in a Competence-based Learning Framework

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Personal Learning Environments in a Global Higher Engineering Education Web 2.0 Realm

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Abstract—This paper presents investigations on formal and informal requirements for personal learning environments taking into account students' personal and social learning practices. The potential of global Web 2.0 educational service bundles and informal learning communities, as well as their recommendation by educators are addressed. A scenario showing how these new paradigms can be integrated in engineering education as a way to bring together personal and social learning practices is drawn.

Web 2.0; Personal Learning Environments; Mash up; Social Learning; Personal Learning; Educational Widgets; Learning Communities

SUMMARY

Nowadays, Web 2.0 technologies enable students to mash up the learning resources, the learning services and the learning communities of their choice. The same technologies also enable educators to move from blended learning approaches to blended contents (blogs, wiki, repositories) and blended learning environments called personal learning environments (PLEs) [1]. Such environments will progressively replace, or at least complement, learning management systems (LMS) in the coming years in a move towards personal and social learning.

Higher engineering education institutions should have a closer look at the informal personal and social spaces and practices, which are expanding at a global scale and are giving students access to an unlimited realm of potentially valuable resources and experts. Hence, a challenge for academic institutions is to integrate in a proper way the students' practices and environments in the existing institutional ones in order to take advantage of them. Another challenge is to support the students in their informal learning practices and in the construction of their learning environments and networks as a next step in increasing digital literacy. Students nowadays need recommendation regarding trusty resources and networks [2] that go beyond the traditional brick-and-mortar universities.

This paper discussed the motivations and the challenges associated with the introduction of personal learning environments in higher engineering education. In addition to highlighting the need for a fundamental change necessary in the educational paradigm to better account and support personal learning, essential pedagogical and technological requirements pertaining to PLEs are pointed out, such as self-

regulated learning, community based learning, or interoperability standards. Especially, usability is elicited as one of the most challenging features of personal learning environments, together with the need of powerful recommendation capability to help learners find relevant resources and people in the Web 2.0 realm. The recommendation should be self-directed by unobtrusively involving the learner in the process, and by taking into account his/her learning contexts and interests, as well as his/her network of trusties.

Personal Learning Environments (PLE) are virtual spaces aggregated by learners at a specific time, for a specific purpose, and in a given context. The contextualization and repurposing of the PLEs should be enabled according to implicit or explicit learning strategies or competence gaps.

An example of a novel Web 2.0 social software that can be exploited in engineering education is presented, together with an implementation scenario for laboratory activities associated with a control course. This example shows how both the pedagogical and the learning environment design can be adjusted for a better integration of formal and informal learning practices [3].

As an emerging topic in field of technology enhanced learning, the design and development of open and responsive PLEs is deemed challenging. A number of controversies entail further scientific discourses and more empirical validations. Amongst others, we name several examples: striving the balance between system-driven and user-driven personalization mechanisms (cf. the privacy issue pertinent to user profiling), deepening the understanding of trust-building enablers and integrating them into recommendation protocols, and identifying viable means to sustain the development of ever-augmenting widget-landscape.

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Filling the gap of Information Security Management inside ITIL[®]: proposals for posgraduate students

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Abstract—This paper describes different proposals made at UNED, for pos-graduated students, at the area of IT Services Management and specially trying to fill the gap, of paramount importance, of the treatment due in ITIL[®] (Information Technology Infrastructure Library) to Information Security management. We analyze the treatment given to Information Security Management in ITIL, both versions 2 and 3, and describe the different at distance posgraduated courses we offer that fill these methodologies and discuss the opinions and evaluations of our students.

Keyword: information security management, ITIL, ISO 27001, professional education.

ABSTRACT

There are a number of widely applied standards and methodologies used for the alignment of Information Technologies (IT) departments with the business, inside each organization. One of the most relevant is called ITIL[®] (Information Technology Infrastructure Library) [1]. ITIL is the most widely accepted approach to IT service management in the world. ITIL provides a cohesive set of best practice,

drawn from the public and private sectors internationally.

Many public and private organizations worldwide implement these best practices following the version 2 of ITIL but since two years ago there is a new version that it is being implemented also, but in a much more slower place.

From the point of view of Information Security, ITIL version 2 gives a very weak approach to implement a good management. Organizations that implement ITIL version 2 since years ago have had to fill this gap using other kind of approaches.

On the other hand ITIL version 3 gives a much adequate treatment [2], identifying the details of the structure and implementation of the Information Security Management process with the good practices for implementing an Information Security Management System included in the ISO 2700x family of standards [3].

Also we face a situation in which students that finish the Computing Engineering careers, at least in Spain, don't know all these kind of standards and methodologies and don't have a

practical, day to day, approach to implement and maintain a good information security policy within an organization.

Due to all these reasons, and trying to take advantage of the professional practice of some of the authors we began four years ago to offer postgraduate at distance courses for helping students to understand all these matters.

At that moment we offer [4] two different courses:

- 1- Professional Expert in IT Services Management based on ITIL[®] and ISO/IEC 20000.
- 2- Professional Expert in Information Security for Computer Networks.

In this paper we begin discussing what we think is a need to explain the differences in the approaches, of both versions of ITIL, to Information Security and the need for the graduate students to know, at least at a foundation level, these best practices approaches and standards.

Then we present the contents of our proposal for filling these knowledge gaps, explain the characteristics of these at distance courses and how we try to stimulate the acquisition of practical knowledge by the students, promoting the practical work as a significant part of their works for the course.

Finally, we show the students evaluation of the last 3 years for these two courses that really encourages us to refine the courses and follow in the same direction.

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Student Motivation and Cross-Curricular Development through e-Learning applied to Cooperation

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Abstract—Technologies and especially information and communication technologies (ICT) are barrier breaking in the current social scenario. Their use is becoming essential for any professional, and their scope of use is becoming particularly widespread in education due to the existence of communication outside the classroom through e-learning tools. Universities, which play an innovative role in education, are using ICT-based approaches to adapt their learning methodology. In this paper, we present a model where students from first-world universities prepare and adapt course contents for use in educational institutions in developing countries. The objectives of this initiative of students' participating in e-learning projects with developing countries are to improve their motivation, develop a set of cross-curricular competencies, and transfer technologies within the scope of university development cooperation.

Motivation; e-learning; development cooperation; cross-curricular competencies

SUMMARY

Over the past few years new and increasing concerns have emerged in Europe regarding education-related topics that were not taken into account until now [1]. Higher education, as a source of development, culture and science, is responsible for achieving an additional objective: human development. Educational institutions, and especially universities, are the cradle of the citizens who will determine the direction of progress in our global society in the near future.

Educational priorities have changed, and an academic education—and this applies to any field, including new technologies and technical studies—is no longer considered complete if it does not consider student instruction in topics related to human development and social awareness. An overview of the different problems affecting society means that the involvement of higher education students has to go beyond the scope of projects exclusively related to their field of work.

This change should be made simultaneously by all players in the higher education system. However, it is very common for teaching staff to be reluctant to introduce new methods, partly for obvious reasons, such as the increased workload, and partly due to under-motivation to finally achieve definite educational improvements. On the other hand, students tend to simplify their study methodology to optimize the time they

spend on courses. Due to this lack of interest, most participatory methodologies are difficult to implement. This reality is clearly reflected in courses offering the option of assessment either by a final exam or through continuous coursework and group work, where many students opt for the traditional method and reject the educational improvement. Both students and the professors perceive that the workload is heavier, whereas attainment is similar. But, is attainment really the same? Of course, not. So, how can we motivate the two groups? Development cooperation naturally promotes both student motivation and some of the key competencies in higher education. Group work, communication, learning of other languages, awareness through development, and respect for the environment, are but a few of these skills. We propose a methodology using e-learning applied to university development cooperation in Third World educational institutions applying a project-based learning strategy [2], as an effective instrument for motivating professors and students at a First World university, i.e. a highly motivating methodology for students and professors in a developed country. Project-based learning, or rather social project-based learning in this case, should be understood as a model for classroom work and homework that expands student learning with practical and real-world issues. This work with real-world projects is probably the key element of our learning approach that makes it so motivating for professors and students.

This proposal has already been successfully tested by the TEDECO cooperation group at the Universidad Politécnica de Madrid in partnership with the University of Ngozi in Burundi. In this context, the cooperation group has exploited its expertise in information and communication technologies to work on a proposal for using ICT tools (adapted e-learning tools) to improve education in developing countries [3].

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Practical Framework of Employability Skills for Engineering Graduate in Malaysia

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Abstract— The purpose of this paper is to propose a practical and simple framework of engineering employability skills that will allow the concept to be explained easily and that can be used as a framework for working with engineering graduates to develop their employability before entering workforce. The framework was developed from existing researches on engineering employability skills issues and the requirement of the accreditation of engineering programme. The various skills of employability skills related to engineering included in the framework are discussed and their criteria justified bases on literature review of existing studies. The framework sets out exactly what is meant by engineering employability, in clear and simple terms, and the framework suggests directions for interaction between the various skills. The relationships between the skills within the framework remain theoretical. Further research to test the framework is planned and will be reported in future paper. The framework can be used to explain the concept of employability to those new to the subject, and particularly to engineering students and their future employer. It will be a useful tool for lecturers, careers advisors, trainers, employers and any other practitioners involved in employability skills. It will also be used to develop a model and a measurement tool for engineering employability skills. This paper contributes insights into the linking of graduate attributes, using national accreditation criteria and the framework of engineering employability skills from locally and globally expectation. It will be of value to anybody with an interest in employability issues.

Keywords- Engineering; framework; employability; graduates; employers.

SUMMARY

The overview of overseas literature on framework for engineering related skills in this study has identified a

renewed interest in engineering-related employability skills. The *engineering employability skills* is defined as ‘Ability to perform engineering related skills, knowledge and personal attributes to gain employment, maintain employment and succeed in the engineering field.’ In the study, the framework has been referred to Malaysian engineering employability skills (MEES). The framework proposed in this study inline with the work that has been undertaken overseas, particularly in Australia, the United Kingdom, the United States of America and European United [2]. MEES comprises the *personal attributes, personal skills, and knowledge* that are required by stakeholders/employers to enable engineering graduates to enter workforce, and progress in career path [1]. The identified technical and nontechnical skills included in the framework are accepted as commonly applicable in the all area of engineering. The framework explains the concept of employability to those new to the subject especially to engineering students and their future employer.

The revolution of knowledge, technologies and workplace processes need for ongoing skills development in employees for emerging new occupations and changing skills requirement.

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A Proposal for the Evaluation of Final Year Projects in a Competence-based Learning Framework

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Abstract—The authors propose a system for the assessment of Final Year Projects (FYPs) whose educational outputs have been defined previously in terms of competences. For building the proposal, eleven pre-defined competences were ranked and a different weight was assigned to each one. The ranking was made individually by all the authors following a blind two-step process. The first step consisted in ordering the competences by relevance and the second step in grading that relevance for each pair of competences having consecutive positions in the list. As a result, an overall weight was computed for each competence and the final proposal was produced by averaging the individual proposals. In addition, three moments are defined for the assessment of FYPs: the FYP process itself, the written report and the oral presentation. Bearing in mind this, the competences that can be evaluated in each moment are identified and a specific assessment form for each moment is also proposed.

Keywords—component; engineering education, student assessment, competence-based learning, final year projects

SUMMARY

Project-based learning (PBL) has been recognized for long as a very valuable tool for engineering courses, since it helps students in developing skills that are closely linked to the execution of professional engineering tasks. The recognition of this value of PBL has led to the inclusion of project development activities in engineering courses, being the “Final Year Project” (FYP) the most remarkable of these.

In the currently ongoing process of creating the European Higher Education Area, the educational outcomes of university courses are being defined in terms of competences that are to be acquired by the students in order to get their degrees. In this context, both a definition of the pedagogical content of FYPs in terms of competences and a systematic assessment system linked to those competences are needed.

The issue of defining the educational outcomes of FYPs was approached by the authors in a previous work [1]. Within that work a set of eleven competences relevant for FYPs were identified and the specific learning objectives and student tasks to be realized during the FYP were pointed out, considering the pre-defined competences.

In contrast, in authors’ view, the question of defining a systematic approach to the evaluation of FYPs has not been satisfactorily solved so far. While it is true that the problem of assessing student projects is not new and that rubrics are becoming a standard for such assessment [2], the definition of rubrics for all the assessable aspects of FYPs is cumbersome, their usage could be too time-consuming and an excessive number of them could also mislead the attention of the juries into too specific aspects of the work, thus loosing the global view. Another aspect of the evaluation of FYPs that is not defined yet is the ranking of competences, that is, the specification of which aspects should contribute the most to the final marks assigned to the students.

Within this paper, the authors propose a system for the assessment of FYPs whose educational outputs have been defined accordingly to [1]. For making the proposal, the eleven selected competences were ranked and a different weight was assigned to each one. The ranking was made individually by all the authors (all lecturers in communications engineering courses) following a blind two-step process, blind meaning here without knowing the proposals of the rest of the authors. As a result, an overall weight was computed for each competence and the final proposal was built by averaging the individual proposals.

Also starting from the work in [1], three moments are defined for the assessment of FYPs: the process itself, the written report and the oral presentation. Bearing in mind this, the competences that can be evaluated in each moment are identified and a specific assessment form for each moment is also proposed within the paper. In the design of the forms, both the simplicity and the prevalence of global aspects have been pursued.

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Learning network protocols through WSN based games

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An Interdisciplinary Practical Course on the Application of Grid Computing

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Introducing Scenario Based Learning: Experiences from an undergraduate electronic and electrical engineering course.

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Mechatronics E-course for regular students and adults: realization and comparison of efficiency

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Distance Practices in Subjects of Automatic Control

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A web-based e-learning tool for UML class diagrams

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Learning network protocols through WSN based games

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Abstract—Learning network protocols is not an easy task. We use them every day, but they have become transparent, as they are integrated in the Operating System. Its use also implies the interaction between different devices, including aspects like concurrency, noise and multi-threading. As a result, the student sees this subject as not necessary, and difficult, easily losing his interest in the matter. This document is a summary of the work developed in an undergraduate course, where Wireless Sensor Networks (WSN) based on Sun SPOTs have been used to improve the comprehension and interest of the students. In the undergraduate course Network and Communications, a Game based lab has been developed. The results show the improvements from previous years.

Network protocols; Wireless Sensor Networks; Game based learning

I. INTRODUCTION

Learning network protocols is not an easy task. We use them every day, but they have become transparent, as they are integrated in the Operating System. Its use also implies the interaction between different devices, including aspects like concurrency, noise and multi-threading. As a result, the student sees this subject as not necessary, and difficult, easily losing his interest in the matter. For this reason, it is necessary to find ways to motivate the student to learn network protocols.

Since 2005, we have been searching new methodologies to simplify the learning of network protocols and its development through the use of Wireless Sensor Networks (WSN). The first step was to use TinyOS based nodes. The results were good. The main difficulty was that the student required half the laboratory time to learn the NesC language that uses this platform.

For this reason, we continued searching, and in 2007, Sun Microsystems provided its SunSpots platform, based on Java. This change of platform has reduced in large amount the learning curve, as all the students are familiar with the Java language. The devices are also well integrated in a development environment (IDE). This IDE provides also a simulator, allowing the students to work at home.

This platform was in autumn 2008 and 2009 in the Networks and Communications course.

II. NETWORKS AND COMMUNICATIONS

The first WSN used in this course were tMotes. It was a simple and cheap option. The main difficulty was the necessity to learn a new language. This reduced to a half the available time. For this reason the laboratory was focused to develop the protocol, and a small application. The laboratory was seen as an academic subject, with little applicability. This reduced the motivation of the student, and they just did the minimum to pass the lab.

The change to Sun SPOTs[1] meant that they do not have to learn a new language, just a small API. This increased the available time, so the laboratory objective was changed to develop networked games. They could use any transducer available in a SunSpot (sensors for acceleration, temperature and humidity, switches and leds) to create a game.

This change in the objective modified the vision of the laboratory. They developed the protocol because it was a need for the application, and optimized it to improve the game. Also, the availability of a simulator allowed the students to continue their work at home, increasing the available time.

As a result, students have developed a strong interest in the subject and a special motivation with the use of the acceleration sensor. The consequence has been a significant improvement of the laboratory qualifications.

III. CONCLUSIONS

WSN have proved to be a good platform to learn network protocols and its applications. In both courses, the students have presented a strong interest in the subject, and better understanding.

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An Interdisciplinary Practical Course on the Application of Grid Computing

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ABSTRACT

In 2008, researchers from diverse disciplines, i.e., computer science, physics, medicine and the humanities joined their shared interest to provide an advanced course in “Grid Computing” [4] at the University of Göttingen. Grid computing is an important research area in computer science, and it connects and advances research of the participating disciplines.

The goal of the course was not that the humanities scholar has to program or that the computer scientist needs to learn the processes of the genetic prediction, but that they work in a complementary manner and solved the assignments jointly. In this sense, the skills that were conveyed by this course went far beyond the technical ones of applying grid computing.

In the course, concepts and usage of grid computing in an interdisciplinary manner were taught. The three projects of the German D-Grid Initiative [6], all related to the disciplines mentioned above and located in Göttingen, and their involved expertise provided an excellent base for studying and learning by practical application of grids by the students. Therefore, the assignments addressed HEP Grid [2] of physics, MediGRID [5] of medicine, and TextGrid [7] of the humanities. All assignments are connected by the area of computer science.

Each discipline developed a block of assignments, whereas each of the blocks referred to the corresponding D-Grid project. The students worked on the assignments in a rotating order. The blocks of the assignments were structured in (1) Introduction and fundamentals, (2) Exercises and practice, and (3) Reflection and further discussions. The way to the solutions of the assignments included that the students learn to apply their knowledge on other disciplines but also to explain their field of study to students of other fields as for example for a realization of inter-domain software. For this, the topic grid computing builds a bridge, because it offers innovative opportunities and promising ideas to develop for each discipline. The students needed to solve the assignments by combining advantages of each discipline through developing, applying, and experiencing different solutions. The students learned to propagate their ideas and to communicate problems as it was best for the interdisciplinary solution and furthermore, to realize them in a grid computing environment using resources most efficiently. The participants got insights in each discipline and learned to develop solution in cooperation with students of other disciplines as it is also

expected from the professional world in which the disciplines often melt.

The course was first given in the summer term 2008 at the University of Göttingen. The participants were grouped so that in each group at least one student of each discipline attended. Each discipline provided a tutor for supervising the students. For the establishment of a local grid environment, several computers located in the local computer pool were provided to each group. The functionalities of grid technologies have been explained by practical applications on a grid environment using the grid software Instant-Grid [1]. Instant-Grid contains all necessary software to automatically set-up a self-configured grid on computers in a local network by booting from CD. Within such an environment, the students were able to start, build, and use an experimental grid system for solving the assignments of the different disciplines. Instant-Grid employs the Globus Toolkit 4 [3] grid middleware and includes a complete security infrastructure and services for job management, data handling, and information delivery.

This environment allowed the students to study and use it at any time without the restrictions that are associated with a remote production grid environment. This article describes the assignments of the different disciplines, the management of the course, the challenges and issues, the benefits, and the infrastructure of the interdisciplinary practical course about the application of grid computing at the University of Göttingen.

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Introducing Scenario Based Learning

Experiences from an Undergraduate Electronic and Electrical Engineering course.

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Abstract— **The aim of this work is to introduce scenarios into the first and second year of our undergraduate electronic and electrical engineering curriculum to improve the educational and learning experience of our students and in doing so improve the quality of our graduates. This paper introduces the curriculum development involved in the implementation of scenarios. We reflect upon and analyze the successful aspects of this trial and identify those areas that are in need of improvement.**

Keywords – *Student centred learning, scenario-based-learning*

I. INTRODUCTION

The UCL Electronic and Electrical Engineering (EEE) Department, in which this study is based, runs two undergraduate programmes: a three year BEng and a four year MEng. We aim to produce graduates who have a strong theoretical grounding in the fundamentals of the discipline, are capable of independent thought, able to approach new problems, can communicate results to others in a logical way and work in a collaborative environment.

Both students and academic staff have expressed a number of concerns with the undergraduate program. Students often express the frustration they have when they come into the program expecting that it will be more hands on, where they get to solve real world problems and build electronic devices. What they discover, however, is a very theoretical course delivered in a traditional way. Academic staff are concerned that student motivation and performance has decreased by the time they get to the second year.

In an attempt to address some of these problems, we proposed to introduce a series of, week long, engineering design projects called scenarios, where students work in small groups and the entire week is devoted solely to the scenario. The scenarios are designed to draw on and consolidate the lecture material that the students will have received in the preceding weeks. As such, planning of the course and design of the scenario needs to be carried out in an integrated fashion with emphasis on horizontal integration across lecture courses and application of knowledge through engineering design projects (scenarios). The scenario is designed to place the students in a realistic situation, where the problem is fairly open and as such the outcomes are undetermined. The use of a

series of short focused scenarios in the first and second year, rather than the more often used design project running over an entire academic term in parallel with lectures, was designed to: enable a greater range of areas within the curriculum to be covered, simplify time management for the students, and provide increased opportunity to provide formative feedback that the students can apply in upcoming scenarios. Here we reflect upon and analyze the successful aspects of this the first year of this trial and identify those areas that are in need of improvement.

II. DISCUSSION

The trial has shown that it is realistic to complete a practical engineering design project - ‘from concept to product’, that both excites the students and enhances the material covered in lectures, within a week.

The use of staging and checkpoints throughout the week was particularly successful in guiding and providing feedback so that the students applied the knowledge and theory gained from lectures to the design problems. This was reflected in the quality of the reports, which are actually more important than the actual solution/device produced, far exceeding the expectations of the staff involved in assessing them. Student feedback on the project timescale was also generally positive.

The group working aspects of the scenarios were particularly successful, despite the reservations, based around contribution, that come with using group work for summative assessment. The students particularly liked social aspects of this learning process. In particular, it was clear that the weaker students gained enormously by learning from their peers and the stronger ones learnt much about leading a team. Daily group progress meetings and peer assessment for moderation the individual marks will be introduced in future scenarios to ensure that the credit received more accurately reflects the contributions of the individuals to the team performance.

The student feedback on the scenario topics, practical and design aspects was very positive. Their engagement and participation in the scenario weeks was high with the competitions generating a real excitement amongst the groups.

Mechatronics E-course for regular students and adults: realization and comparison of efficiency

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Abstract— This paper describes execution and gained experience with two practically oriented E-courses from mechatronics. Both courses have in common that they include remote experiments and are executed completely online, which is still rarity in the practically oriented engineering education, especially in non-university education. The execution details and educational approach applied in each course were adjusted to two specific target groups. The target groups of a first course ‘Control of nonlinear mechanisms’ is a group of regular local and regular international students of mechatronics. The target group of second course ‘Basics of mechatronics’ are employed and unemployed adult professionals from various engineering fields who have already finished their formal education but want to acquire new knowledge. For both courses interactive E-materials and E-tests in Slovene, English and partially also in German language are available within two learning portals, also adjusted to the needs of each target groups. First course was tested with 40 regular students and the second course with the group of 70 adult professionals mostly from industry. While adult professionals appreciated the fact that the course was executed completely online, the regular students have still preferred conventional lectures and especially conventional laboratory exercises over remote ones. Based on the teaching instructor’s observances and on the results of anonymous questionnaires, the advantages and disadvantages of the replacement of traditional laboratories with remote laboratories are discussed from a critical point of view.

Keywords—education; remote laboratory; mechatronics; adult education; vocational training; distant education

SUMMARY

Until recently the distance education courses for engineers were quite rare, although the distance education is due to its many advantages already quite widespread in other non-engineering disciplines. The main reason for this is that efficient engineering education should include experimental work on real devices, which usually takes place in laboratories and therefore requires personal presence of the learner. This has recently changed with the introduction of distance laboratories that enable remote execution of experiments from anyplace and at anytime.

In the paper two distance courses are presented. Both aim toward of offering practical experience by incorporation of remote experiments. First course is intended for education of regular students of mechatronics from eleven European countries. This course ‘Control of nonlinear mechanisms’

introduces the students to modelling, simulation and motion control design and implementation for nonlinear mechatronic devices. The course was already successfully implemented in the regular education process of 40 local students. Students’ feedback was obtained by anonymous survey and is analysed in the paper. Despite the fact that remote experiments can be performed independently of the place and time, 61% of the students prefer executing the experiments in the laboratory over remote experiments, 33% could not decide for one option and only 6% prefer remote experiments. As much as 78% of students have the opinion that they learn more in laboratory work than in remote experiments. The other 22% could not decide for one option.

Second course ‘Basics of mechatronics’ is designed for employed and unemployed adult professionals who have already finished their official education. This course was tested by the adult participants with very different background knowledge, various levels of official education and also very different interests. The pilot training for adults was executed with 70 participants in March-April 2009. The majority of the participants were working in industry; some are tradesman and some unemployed.

The training is composed from four modules; Introduction to mechatronics, Servomotor in mechatronics, Electrical circuits and Mechatronic devices and requires around 50 hours of intensive work. Each module is given with complete e-materials in SCORM format. Exercises are given for each chapter and there is also an extensive e-test for each module. Each module also includes some remote experiments. The experiments are performed on three devices: servomotor, circuit with different type of filters including switched capacitor filters and on two degree of SCARA robot. All experiments are implemented within DSP-2 based remote laboratory (<http://www.weblab.si/>).

Obtained feedback shows that in contrary to the regular students, the adult professionals highly appreciate the possibility to participate in the completely online course as it can be easier fitted in their busy schedule.

Both courses are going to be implemented and regularly updated also in future. The training from basics of mechatronics which was developed for adult professionals is also going to be commercially offered to the companies for the supplementary education of their employees.

Distance Practices in Subjects of Automatic Control

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Abstract— This work aims at suitably combine the hands-on and remote practices for teaching of automatic control subjects. The use of Virtual and Remote Laboratories in Automatic education is more and more a method resorted by the universities to offer a flexible service in schedules and a greater and better operation of the available resources. This paper shows the results using Distance Laboratory System (SLD) and AulaWeb, in Regulación Automática I of the Universidad Politécnica de Madrid. The distance and virtual practices, made in SLD, are combined with the question in AulaWeb to form Web self-assessment tools.

Keywords- education of control; remote control; remote laboratories; virtual laboratories; innovative education

SUMMARY

Laboratory experiments are an essential part of engineering education, providing a complement to theoretical lectures. The use of simulation tools for training has been popular, mainly due to the high cost of maintaining and operating laboratories equipments. The advent of computer technology, particularly the arrival of the Internet, has added new opportunities for the sharing of expensive software and hardware resources. Consequently, virtual and remote control applications have been developed.

Distance Laboratory System (SLD) is a remote laboratory that allows learning and adjusting predefined controllers, designing new controllers, and testing and analyzing the performance of the predefined/designed controllers over a set of physical devices [1].

AulaWeb is a Web self-assessment tool (WSAT), used as an aid for students and teachers of academic subjects. AulaWeb was built by the UPM and has been tested at several engineering schools and used by over 2000 students each year.

The paper shows a suitable combination of hands-on, remote practices, virtual practices and variable questions in the subject of Regulación Automática I at the Universidad Politécnica de Madrid, using SLD and AulaWeb.

The Regulación Automática I activities have been classified in lecturers, solving problems, hands-on practices, virtual and remote practices, control project, tutorial, seminars by experts from the industry and exams.[2]

The subject has three real experiments in the laboratory of automatic allowing the implementation in real time of a system

of control with continuous regulator (PID), the development of a model of Simulink in real time testing on a physical system and the implementation of discreet regulators $R(z)$.

Self-assessment tests are done at the end of each topic in order to check the knowledge acquire by the students previously to carry out the experimental work. This activity is performed by using AulaWeb.

The control project is an activity that is made so that the student applies the knowledge acquired in the accomplishment of a control system. The student must choose what technical of modeling and what control tools has to use at every moment.

The SLD is used to make virtual practices and real practices in a remote way. It is also utilized in the development of the integrated project.

The combination of hands-on practices in the laboratory and remote practices was used as methodology, taking advantage of both variants.

A survey on the subject was carried out and shows that the results obtained in the subject were good. The students were motivated with the use of the SLD for the integrated project.

As conclusion, the use of the SLD brings about a more flexible use of hands-on laboratories and a more rational use of the resources available. In addition, SLD offers the students great possibilities of development and investigation while trying studied algorithms of control in physical plants. The main benefit obtained to date is the reinforcing of the students' learning process when using the combination of hands-on and remote practices. This is derived from the fact that the real hours allow them to familiarize and manipulate the physical equipment directly, whereas remote working hours permit them to test different algorithms and techniques from control without the schedule restrictions.

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A web-based e-learning tool for UML class diagrams

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Abstract—The paper presents a web-based tool designed to give support to teaching and learning of UML class diagrams. The proposed UML environment is capable to correct automatically UML class diagrams exercises providing feedback to the student immediately. The tool is part of a more general framework, denoted ACME, which provides the main functionalities of an e-learning platform. The tool has been used in a first experimental group of an introductory database course.

Keywords: UML class diagrams, web-based tools, e-assessment

SUMMARY

The Unified Modeling Language (UML) is the most widely known and used notation for object-oriented analysis and design. The class diagrams of UML allow expressing the static system structures [1]. The UML notation and, in particular class diagrams are fundamental in many different computer science disciplines [2].

Due to the importance of UML class diagrams in computer science, we have developed a tool for giving support to teaching and learning of its contents. The proposed tool is part of a more general framework developed at the University of Girona, denoted ACME, which provides the main functionalities of an e-learning platform.

The proposed UML environment is capable to correct automatically UML class diagrams exercises providing feedback to the student immediately. This environment proceeds as follows:

- UML class diagram problems are stored in a common repository. Each problem is defined by a teacher and consists of a descriptor, presenting the situation that have to be solved, and the description of the possible correct solutions to the problem.
- For each student, the system creates a work-book with a set of exercises that have been selected by the teacher.
- When the student enters into the system he access to his workbook and a list with all the exercises appears. The student selects one of them and enters the solution using a specific graphic interface with all the tools required to generate a UML class diagram. In Figure 1 we illustrate this interface.
- When the student has entered the solution the system automatically correct it. The correction strategy is based on a matching process that compares the student solution with each one stored in the repository. If no matching is found, the most similar solution is selected

and is used to return feedback. These feedback messages give hints to the correct solution. Some examples of error messages are: “More classes are required”, “There are incorrect associations”, etc. When the student receives these messages he can modify the solution and propose a new one.

- The corrector module considers the different solutions entered by the student and according them proposes a mark. This grading process uses a function specifically designed where different parameters are taken into account. For instance, we consider the number of correct/incorrect class/associations, the number of attempts before a correct solution is obtained, etc.
- For each student the system records all the entered solutions. The marks of all the problems are used for continuous assessment.

The proposed approach has been used in an experimental database course with very promising results. The application of the environment enhances the learning process and motivates the student to practice.

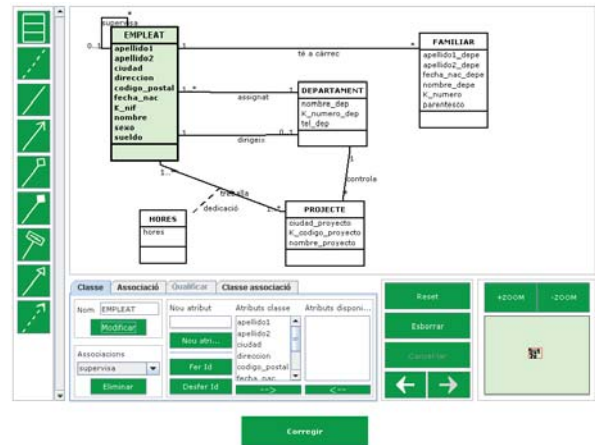


Figure 1. Interface designed to enter an UML class diagram

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Evolutionary algorithms for subgroup discovery applied to e-learning data

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Engaging Weaker Programmers in Problem Solving

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Portugol IDE v3.x

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A Study and a Proposal of a Collaborative and Competitive Learning Methodology

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Educational visualizations of syntax error recovery

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Evolutionary algorithms for subgroup discovery applied to e-learning data

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Abstract—This work presents the application of subgroup discovery techniques to e-learning data from learning management systems (LMS) of Andalusian universities. The objective is to extract rules describing relationships between the use of the different activities and modules available in the e-learning platform and the final mark obtained by the students. For this purpose, the results of different classical and evolutionary subgroup discovery algorithms are compared, showing the adequacy of the evolutionary algorithms to solve this problem. Some of the rules obtained are analyzed with the aim of extracting knowledge allowing the teachers to take actions to improve the performance of their students.

Subgroup discovery; educational data mining; e-learning systems; evolutionary algorithms; fuzzy rules

SUMMARY (HEADING 1)

For almost as long as LMSs exist, researchers have been interested in studying how the usage logs of these systems can be used to improve the learning process. The more used approach to exploit this data uses automated evaluation of system logs and databases [1] using data mining techniques to provide additional information for teaching staff about the quality of the student experience. In this sense, data mining techniques can be applied to analyze student's usage data in order to identify useful patterns and to evaluate web activity to get more objective feedback for instruction and more knowledge about how the students learn on the LMS [2].

Association rule mining is one of the better-studied descriptive data mining methods whose objective is to discover descriptive rules about relationships between attributes of a set of data. It has been applied to LMS in order to reveal which contents students tend to access together, or which combination of tools they use [3].

Subgroup discovery (SD) is a descriptive inductive learning area in which, given a set of data and a property of interest to the user, an attempt is made to locate subgroups which are statistically "most interesting" for the user [4]. A subgroup is interesting if it has an unusual statistical distribution with respect to the property of interest. The objective is to discover interesting properties of subgroups by obtaining simple rules, which are highly significant and with high support.

Genetic Algorithms (GAs) are beginning to be used to solve SD problems because they offer a set of advantages for knowledge extraction and specifically for rule induction processes. A fuzzy approach in a SD algorithm, which considers descriptive fuzzy rules, allows us to obtain knowledge in a similar way to human reasoning, and so the obtaining of more interpretable and actionable solutions in the field of SD, and in general in the analysis of data in order to establish relationships and identify patterns.

In this work we apply two evolutionary subgroup discovery algorithms (SDIGA [5] and MESDIF [6]) to obtain fuzzy rules which describe relationships between the student's usage of the different resources provided by the e-learning systems and the final marks obtained. The objective is to characterize subgroups of students whose final marks are significantly different from those of all students and use this knowledge to improve the learning process. The results obtained by these algorithms are compared, showing the suitability of the evolutionary approach to this problem.

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Computation for Science and Engineering

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Motivated by Mark Guzdial's observation that programming is more accessible when examined in the context of interesting and engaging problems, we have recently developed at the University of Texas at El Paso (UTEP) a programming course offered to entering college students titled "Introduction to Computational Systems" (ICS) that examines the mathematics underlying familiar physical phenomena such as ballistics and resonance.

A typical project in ICS will be a short (4-15 line) program simulating a simple dynamic system whose output is drawn as a raster image. While the plots generated by these programs are essentially equivalent to the display of a graphing calculator, it appears that student definition of the system's evolution as a simple iterated sequence of instructions provides a heightened visceral-level understanding of a system's evolution. Furthermore, much like manipulatives used in math courses, the programs are sufficiently simple to be easily analyzed and repaired when a student discovers that their program evolves in an inappropriate manner. The preliminary evaluation of this course indicates that attendees quickly develop competency at basic programming tasks and have favorable attitudes towards learning about the mathematics of dynamic systems using computation in this manner.

Driven by the early success of ICS course, we are developing a new curriculum for the introductory computer science class for students not majoring in computer science. Computer Programming for Scientists and Engineers (CPSE) is a course at UTEP intended to teach basic computer programming skills to undergraduate students majoring in STEM disciplines other than computer science. The previous curriculum was a traditional introduction to programming that focused on the syntax and semantics of the C language and did not draw connections to attendees' majors. CPSE attracted too few students to be offered regularly.

We describe a new curriculum for CPSE, now titled "Computation for Science and Engineering" (CompSE), which will be introduced in Spring 2010. CompSE offers a more problem-oriented approach to learning programming concepts and uses the pedagogical approaches of ICS curriculum to introduce programming as a tool for understanding the dynamism of relevance to attendees' majors.

One of the main goals of CompSE is to attract students not majoring in computer science to computational sciences courses and stimulate their interest in continuing study of

computation. To achieve these goals, CompSE aims at attaining three main learning objectives.

1. Students will examine and understand the basis of analytical techniques that they have probably seen and memorized in mathematics or science courses but have frequently not been comprehended deeply enough to apply them to real-life problems.
2. Students will learn how computation can be used to analyze problems that are difficult or impossible to understand using only analytical techniques, and
3. Students will realize that real-life problems expose common challenges to simulation such as catastrophic errors due to effects of round-off error or inappropriate simulation interval.

Families of dynamic systems are examined as threads of inquiry drawn from various disciplines in which layers of complexity are progressively added to increase the realism of the computational model. We begin with a financial modeling thread that first implements simple (linear), and then compounded (exponential) interest that might be offered by a bank.

Subsequent labs examine the selection of alternative investment instruments such as stocks and real estate. We first consider two criteria for investing in stocks – return and risk, for which we can define a stable relationship: if the return of a stock increases, the risk of investing in this stock increases as well. However, in reality, when the risk reaches a certain high point, no one will invest money in the stock even if it offers high return, and therefore the linear relationship between return and risk become invalid, and the course then explores models of how a financial system can continue to evolve including the risks of oscillatory behavior, market crash, and various approaches that can lead to stable recovery.

In order to deepen understandings sufficiently to introduce control theory and elicit knowledge transfer of foundational concepts, similar dynamism is examined in subsequent threads drawn from other disciplines such as environmental science and molecular biology.

Our planned evaluation will examine both the effectiveness of the course in achieving student learning objectives, and student interest in continuing multi-disciplinary studies that include computation and programming.

Engaging Weak Programmers in Problem Solving

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Keywords: collaborative learning, programming, problem solving, self-reflection

I. EXTENDED ABSTRACT

As with many schools attracting international students, our postgraduate degrees must cater for students with diverse backgrounds and skill-levels. It is not practical to accurately assess students' domain-skills prior to enrollment. Thus, we found a need for a compulsory bridging course with the dual objectives of improving the problem solving and programming skills of the weakest computer graduates whilst still challenging and improving the skills of experienced programmers. This paper describes our experience in refining such a course over five semesters, in order to meet these goals.

Inspired by ideas from Astrachan[1] in first year undergraduate teaching, we based our course on practical application of programming to realistic TopCoder-style[2] problems. To cater for our cohort, we modified his approach in two key aspects:

- the use of cooperative learning strategies[3] to support the transfer of skills between students.
- course assessment based *primarily* on graded sets of these realistic problems, to better assess and directly address specific deficiencies in problem-solving skill sets.

The course has a two-hour weekly lecture presenting algorithmic techniques for various problem types. Cooperative learning is supported through weekly group-programming practice sessions offering a mix of new and familiar problem types. Sessions run with groups of approximately four students; each group was assigned one or more problem. A group representative is picked to present solutions to the rest of the class at the end of each session. Groups are generated using a genetic-grouping algorithm, to maintain some inter-group uniformity. Groups are encouraged to continue practicing on problems outside of class time.

Assessment began with a diagnostic exam early in the semester followed by practical exams every 2-3 weeks. Each practical exam consisted of three problems of differing degrees of difficulty. A passing grade could be obtained by solving at least one problem in each exam. The problems were automatically assessed with students being able to immediately see test results for their solutions and resubmit if some tests failed.

Our first offering of the course worked for students who were able to solve simple problems on commencement. These students enjoyed the course, progressed well, and were able to tackle harder problems as the course advanced.

Unfortunately, less-skilled programmers struggled from the start and either deferred the course or failed. After two consecutive semesters of teaching, we reflected on the performance of the struggling students compared with those who thrived and gained the following insight: *all* students were able to sketch a feasible solution for most types of simple problems. But weak programmers often overlooked one or two boundary cases and, thus, they failed some test and they were not able to identify the causes of their failure.

The less-skilled programmers commonly exhibited the following behaviours: spending most exam time fixing failed input cases one by one, breaking working parts of the code in the process; a reluctance to go back and work through their solution on paper or change their strategy; diminishing attendance lectures as the material moved on to address more advanced concepts; and a passive role in their group practice.

This paper will report the changes to the course delivery aimed at keep less-skilled programmers engaged, by addressing the problems identified above one by one.

The changes were based on encouraging self-reflection from the start so that each student could identify and assess the strategies they were using. This, combined with some one-on-one coaching, helped programmers to focus on better development and testing of algorithms prior to coding – yielding much improved performance in exams.

We believe the strategies used in this course, based on aspects of deliberate practice[4], would be applicable to other technical courses with mixed cohorts.

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Portugol IDE v3.x

A new environment to teach and learn computer programming

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Abstract - Teaching of programming is crucial in every engineering course and particularly in computer courses. Students failure in this domain has led to the development of Portugol IDE, a tool for teaching/learning algorithms. This tool allows algorithms to be coded in mother tongue of portuguese students (portugol) or in flow diagrammatic language (flowchart) and its automatic execution. This paper presents generation 3.x of this tool and describes the advancements therein

Keywords-component; programming learning; portugol; flowchart; computer science education .

SUMMARY

All courses in computer science related areas include in their curricula an introductory module on programming, which usually has high rates of failure. The concepts taught in this introductory module will be used in many other course disciplines and the rates of failure are deemed as one of the major reasons for student drop-out from these courses.

This serious drop-out rate has been a subject for research and several recommendations from computing professional associations (e. g. ACM e IEEE). Many different strategies and tools have been proposed to improve the teaching/learning process of programming basics. With this in mind, faculty members and students of the School of Technology of the Polytechnic of Tomar have developed an innovative environment for teaching/learning algorithms - Portugol IDE.

This freeware and open source environment has been used in the Polytechnic of Tomar, in national and foreign higher education institutions and in high schools and professional schools[1][2].

Given its success and in order to broaden its scope of application in the teaching of programming, the authors have developed generation 3.x which features a more advanced language and a new environment.

Advancements in Portugol IDE have reflected the needs and suggestions from faculty and students regularly invited to

contribute to its development both at the level of system encoding and at the level of introduction of new tool features. This symbiosis between the two parts of the teaching/learning process causes Portugol IDE to be a widely used and appreciated tool by the whole academic community in the Polytechnic of Tomar.

This paper includes an overview of this tool (Portugol IDE) and the pedagogical characteristics that make generation 3.x an asset for the teaching of programming. The new features of generation 3.x include:

- Core Enhancements - Possibility of defining complex data (arrays and structures); iterative and recursive functions; multilingual support for coding.
- Environment Enhancements - Display the memory for complex data; Support for functions in the flowchart; possibility of coding debugging and executing the algorithm in many languages (Portuguese, English, Spanish, Dutch and French).

New features are already being studied with the aim of promoting a virtual ecosystem in the framework of Portugol IDE, including its articulation with learning management systems, learning content management systems and learning objects repositories.

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A Study and a Proposal of a Collaborative and Competitive Learning Methodology

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Abstract— Competition is evident throughout our society, lives and work. “It transcends time and place, as well as all manners of people”. In this paper, we present a study and a framework proposal for a mixed collaborative-competitive learning environment, applied to a programming course in a University level engineering program. We believe this mixed-based learning approach best serves students as they are able to achieve academic success both in working with others and on an individual basis. Besides the traditional theoretical lessons and laboratory practices of the course, the integration of the framework automates all the support and evaluation processes. It implements both an individual competitive setting and a collaborative one, where intergroup competition occurs, by means of two interconnected modules. We discuss our results and findings in its preliminary use, concluding that the framework promises to have a good impact in the way we teach some programming courses in our Institute.

Keywords—competitive learning; collaborative learning; programming language innovation; automated evaluation framework.

SUMMARY

While neither collaboration nor competition is inherently good or bad in supporting the learning process, the way teachers employ these strategies in classrooms determines their value in preparing “soon-to-be” professionals [1]. An effective classroom must have the right mix of cooperative learning and competitive learning (along with individualized learning) [2]. These two learning techniques do relate to the workplace of our times. Often in the business world people work on a variety of team settings, thus, collaborative activities in a classroom can prepare students for the experience of their professional lives. Employing competitive learning has a complementary potential to engage students.

This work presents a study and a methodology proposal for a collaborative and competitive learning setting. It is based on a computational framework (Fig. 1) currently being under development for a programming course on a Polytechnic Institute engineering program. Besides the usual theoretical lessons and laboratory practices, the integration of the framework in the course automates all the support and evaluation processes. It implements two competitive settings instantiated by the Champions League (CL) module and the

Automated Test and Group Ranking (ATGR) module. The first module targets an individualized type of competitive learning, where students are selected to participate in a tournament with a group stage and a knock-out phase. The later module aims at an intergroup competitive setting, in which balanced student groups are formed, competing among them. A third module is predicted to be implemented in the future, where the actual programs coded by the students compete in an arena, but its scope of applicability isn't as broader as the other two – only in artificial intelligence-like programming courses – and will not be further discussed in this paper.

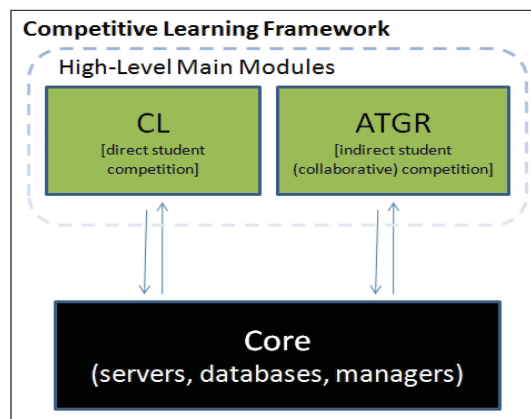


Figure 1. Overall architecture of the supporting framework.

The paper is structured as follows: in Section II we report some related work and studies with competitive and collaborative learning, while the methodology and supporting framework are presented in Section III. In the following section, we discuss our findings and present student opinions for this methodology, based on empirical and questionnaire results. Finally, in Section V, overall conclusions are taken and future work is presented.

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Educational visualizations of syntax error recovery

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Educational technology; Visualization; Computer science education; Languages

Language processors or compilers are considered by the students as ones of the most difficult subjects in Computer Science degree. One of the most difficult parts is the syntax error recovery.

In the syntax analysis points out the syntax tree (ST) comprehension. The ST concept is basic for syntax analysis and syntax directed translation. The understanding of both topics can be improved using visual representations of the ST. Moreover, the tree representation of the ST is quite similar to student's mental representations of the ST.

Card et al. [2] defined visualization as the “use of computer-based, interactive visual representations of data to amplify cognition”. Visualizations, which show the behavior of the internal parsers structures, can be used to make easier the comprehension of the syntax analysis. Nowadays, we have not found any tool which displays the syntax error recovery.

Syntax error recovery (SER) strategies are difficult to understand for students. Also their implementations in the parser generating tools: “Proper placement of error tokens in a grammar is a black art...” [1].

Lexical error recovery (LER) is simpler than SER. LER consist in: transform an unmatched string of characters in a valid string using single character modifications (insertion, deletion or modification) or just report the error and then restart the lexical analysis process with the next character. However, SER has more implications; sometimes it does not work properly creating new nonexistent syntax errors because the parsing task cannot be interrupted. Furthermore, it is necessary to choose the synchronization point which can force to ignore a part of the input stream or to change it virtually.

The main syntax error recovery strategies are error production, which consists in extending the grammar adding new erroneous productions. Panic error recovery strategy allows the parser to ignore the input stream until find any synchronization token. Finally, the phrase level strategy can make local changes assuming that an unexpected token is correct, for example inserting it into the stack.

Parser generators are commonly used in language processing courses, but the implementation of error recovery methods is far from theory. Obviously, error productions can be used with all parser generators. But, the phrase level is mostly used by LL parser generators, e.g. ANTLR. And the

panic mode method is mostly used by LR parser generators, e.g. Yacc, Bison, and Cup. Even changing the concepts, because the parser developer must specify synchronization points with a special error token, instead of specify synchronization tokens associated with productions.

Visualizing the error recovery process will improve students' understanding of these methods. We have developed VAST [3], an educational tool devoted to syntax analysis visualization. One of the most important features of VAST is its generic approach. It can be used with different parser generators; our students have used it with CUP and ANTLR parser generators. Here we describe how VAST visualizes the different error recovery strategies implemented in both parser generators. Figure 1 shows the syntax tree resulting after parsing an erroneous input stream with an LR parser and using and panic mode error recovery.

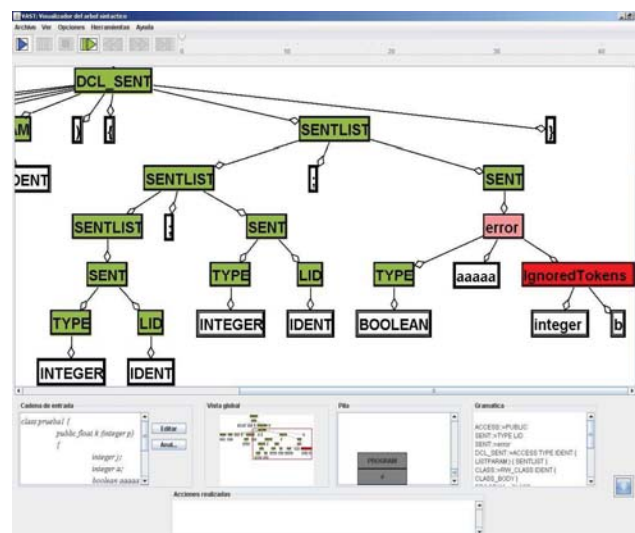


Figure 1. VAST. Panic mode error recovery

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Session: 05E Universia Special Session: International Engineering Cooperation

Tokyo Tech Graduate Program Allied with Thailand: TAIST (Thailand Advance Institute of Science and Technology) - Tokyo Tech

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Engineering in Latin America: A view at the Higher Education Level

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Innovative Practices for Learning Human-Computer Interaction by Engineering Learners

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Engineering Education in the Developing World: Complexity and Sustainability

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Developing Global Teamwork Skills: The Runestone Project

Daniels, Mats;Pears, Arnold Neville
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Technological Development, Sustainability: Discussions about International Aspects of Engineering Education

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Tokyo Tech Graduate Program Allied with Thailand

TAIST (Thailand Advance Institute of Science and Technology) Tokyo Tech

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Abstract—Tokyo Institute of Technology started a new graduate program allied with National Science and Technology Development Agency (NSTDA) and Thai universities in 2007. Distance education is well utilized in Information and Communication Technology for Embedded Systems course. Some background and outlines of this activity is introduced, and effects of distance education are analyzed from various points of view.

Keywords—component; Allied graduate school; distance education; international collaboration

SUMMARY

Tokyo Tech has been active in academic collaboration with Asian countries, and international distance education has been used for about 8 years [1][2]. A new joint graduate school named TAIST (Thailand Advance Institute of Science and Technology) - Tokyo Tech serves as a virtual institution and focal point. NSTDA provides its researchers to act as adjunct professors, research projects and scholarships for graduate students. Thai universities provide an academic framework, academic staff to oversee and guide students and degrees for successful candidates. Tokyo Tech is responsible for most of its coursework. The main objective of TAIST Tokyo Tech is to establish an institution for human resource development to foster and support world-class researchers and high-level engineers through a combination of advising from Tokyo Tech professors, excellent facilities and research staff in NSTDA, and established resources of Thai universities. The participating Thai universities are King Mongkut's Institute of Technology Ladkrabang, SIIT (Sirindhorn International Institute of Technology), and Kasetsart University. Currently two master programs are running; AE (Automotive Engineering) and ICTES (Information and Communication Technology for Embedded Systems). The numbers of enrolled students are 30 each. First year students are expected to enroll in courses taught mainly by professors from Tokyo Tech. The second year students receive scholarships for tuition and fees from research projects of their supervisors. Professors from Tokyo Tech will actively participate in the educational process of the students throughout each program. After a successful completion of both coursework and thesis, the students will receive degrees from the host universities and certificates from Tokyo Tech.

Lecture halls are in NSTDA located in Thailand Science Park, 45km north of central Bangkok. To get rid of long travel between Tokyo and Bangkok (separated by about 4,600km), distance education is effectively utilized. In the ICTES program, 7 lecture courses out of 18 are taught from Tokyo, and some other courses are taught combining face-to-face and distance education. Bidirectional internet link allows students to interrupt at any time to ask questions. Co-lecturers of Thai universities are assigned to all the courses, and they give supplementary talk and/or exercises. Our Center prepared a one-page guide entitled "Suggestions for successful distance education" when we started international distance education. That guide was distributed to professors who give distance lectures for the first time. By the request of those professors, one-hour training was also conducted before official distance lectures. Teaching assistants who help professors by operating equipment were also given necessary training. A new e-learning site is prepared using Moodle on our supercomputer TSUBAME, and all the course materials are uploaded and lecture videos are also available for some courses. Students' grades are analyzed from various points of view. Student evaluation questionnaire survey is also conducted, and the results are generally favorable.

TAIST-Tokyo Tech is expected to initiate the start of a positive spiral of human resource development system in Asian region. TAIST-Tokyo Tech aims to harmonize advanced technology with the environment and to realize research and human resource development for global sustainable development. Two more programs, i.e. Environmental Engineering and Biotechnology, are expected to start soon. We are now seeking the possibility to issue joint degrees.

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Engineering in Latin America: A view at the Higher Education Level

Special Session

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Abstract— A special session is proposed to present a view of the current status of Engineering Higher Education in Latin America with respect to areas in which UNIVERSIA is promoting.

Keywords: Engineering, Higher Education

I. INTRODUCTION

UNIVERSIA, launched in Spain on 9 July 2000 with a clear vocation of serving the university community in Latin America, is the largest Latin American network of university collaboration. It includes 1,100 universities and colleges in 15 countries. Universia partner universities represent 76 percent of the university group of countries where it operates, with 10.9 million students and 885,000 teachers.

UNIVERSIA tries to act as a promoter of change and innovation to help universities to develop shared projects. Also it creates new opportunities for the university community in order to meet the demand of the business environment and institutional sustainability criteria. Its vision in this way is to be the largest network of Spanish and Portuguese that promotes academic and the university-industry cooperation.

II. FOCUS AREAS

This session will include papers concerning the action lines promoted by UNIVERSIA:

1. Information to support learning and training.

- Detecting the necessities for corporate training and disseminating the academic knowledge with training resources throughout universities.
- Disseminating business experience to the university environment.

2. Employment. Practice and career development.

- Helping universities to increase the employment opportunities of graduates in collaboration with university employment services.
- Helping companies in the selection process for graduates and internships.
- Opening to teachers and researchers channels of communication with companies and institutions for business development of research results.

3. Observatory. Center for the future of science and higher education.

- Building physical and virtual spaces for debate and discussion on trends in higher education involving all stakeholders (companies, institutions, universities, government, etc).
- Helping the academic community in the process of transition to the new educational scenario.

4. Social Networks.

- Creating platforms for leisure participation on issues of interest to academics (virtual environments, social environments, chats, blogs, contests, etc.).
- Organizing events that promote responsible and participative entertainment (music, sports, debates, etc.).

Innovative Practices for Learning Human-Computer Interaction by Engineering Learners

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Abstract— This paper presents an innovative experience with teaching and learning Human-Computer Interaction in the field of Computer Engineering in the Faculty of Physical Sciences and Mathematics at the Universidad de Chile. This is a pioneering course in Latin America, and has been offered every year for the past 20 years without interruption. The content of the course is constantly renewed and updated. As a result, students have been able to learn of a wide range of aspects regarding Human-Computer Interaction that must be taken into consideration when designing any kind of software or device for human use. At the same time, students recognize that the issues and methodologies taught in the course are not only useful for their training as engineers, but are also helpful for everyday decision making.

Keywords- HCI Learning, HCI in engineering, constructivist learning, usability

SUMMARY

Traditional or frontal teaching puts the students in front of an instructor who provides them with theories, concepts and a variety of content [2]. In this scenario, the students are mere passive receptors of information that a transmitting instructor presents and explains, be it with the help of old technology (blackboard or whiteboard) or digital technology (projector, computer, etc.) [1]. This way of teaching and learning that responds to a behaviorist-positivist model, has prevailed in education for decades, and is slowly experiencing changes and innovations that point towards a model in which the learner is the main actor and is active in his/her learning, constructing knowledge through change in the meaning of the experience, interaction with others and the organization and reorganization of his/her mental schemes [3].

It is precisely in this new context in which the teaching and learning of Human-Computer Interaction (HCI) in the field of Computer Engineering within the Faculty of Physical Sciences and Mathematics at the Universidad de Chile takes place. This HCI course has been a pioneer in Chile and Latin America. It has been given every year for the past 20 years, being constantly renewed and updated in synch with the newest prevailing technology. As a result, students have been able to learn of a wide range of general situations involved in Human-Computer Interaction that must be considered when designing any kind of software or device for human use. This implies the

development of a capacity for analyzing problems on a technical, cognitive and functional basis from a design perspective, and critically analyzing interactive Interface design methods and techniques.

One of the keys of our HCI course has been the learning methodology and its constant renewal, innovation and updating. This learning methodology consists of applying the theories, concepts and models studied in class to practical, applied, real and pertinent case study projects. On the basis of a global issue dealt with during the course, the students resolve and develop a series of HCI application case studies and a final human-computer interaction project that integrates and unifies the results of the previously developed cases, with increasing degrees of requirements, depth and complexity.

The course presents the students with some application cases studies of a design or the redesign of human-computer interaction that the students must resolve. The students' work evolves from the design of human-machine interfaces to the design of human-computer interfaces. The selected case studies are organized into a central global issue, such as transportation, education and navigation that are finally linked in order to achieve a more complete HCI design, and produce it for the final project.

Finally, we present several interesting and illustrative opinions of several students, several of which have already graduated. The students recognize that the methodology utilized allows them to support the development of other skills that are fundamental for today's professionals. There are even some students who do not only adopt the knowledge and the experience learned in the HCI course into their professional lives, but who also use it on a much more personal basis.

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Engineering Education in the Developing World:

The case for Biological Engineering

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Abstract— Engineering education in the developing world is not only necessary for economic growth, intellectual development and innovation, but is also fundamental for national security and short and long-term sustainability. Successful engineering institutions and productive engineers are not only necessary to create knowledge based economies in developing nations, but they are also important players in maintaining economic viability that is tied to national security of immediate and distant neighbors. The necessity for innovation in engineering education and grounding of this training in local needs and markets is true for all forms of engineering, including biological and biomedical engineering that have been rather recent inductees to the engineering education portfolio. Developing countries are taking biological and biomedical engineering seriously to address issues in food and agriculture, processing and nutrition and various aspects of healthcare and medicine. In this paper we address the need, status, challenges and opportunities for the developing world in bioengineering and biomedical engineering education and discuss ways in which the fundamentals of engineering education can be strengthened for a sustainable society.

Keywords— component; Biological Engineering, Biomedical Engineering, Developing World

Engineering education has been central to national development, security and sustainability in low income and developing nations. With the rapid growth of biological and biomedical engineering in the developed world, the developing world has started to see significant interest and potential of this discipline. In the years to come, biological and biomedical engineering will play a pivotal role in the development, survival and sustainability. Issues related to food production, safety

and security, public health, epidemiology and overall life quality and expectancy are areas where biological and biomedical engineering will play a central role. Increased globalization and rapid growth in these sectors in the developed nations will also have an impact on the practice and education of engineering in the developing countries.

As the government and non-government sectors realize the importance of these areas, more schools, colleges and departments will incorporate biological and biomedical engineering into their mainstream curricula and degrees. In a rapidly changing world, where the issues of food and healthcare are affecting nations across continents and influencing policy debates ranging from national security to immigration, biological engineering will have a central role to play in the developing countries. A shift in perception of biological engineering from a second class engineering to the cornerstone of national security and sustainability will lead to newer challenges in educating the next generation. As we approach that stage, it is more important than it has ever been to focus on quality control in curriculum and teaching and connect the curriculum with national and local needs and challenges. Quality assurance, well organized and up-to-date curricula and partnerships between public and private sector are necessary to shape the landscape of engineering in a way that makes a substantial impact on national security and long-term sustainability of the developed nations.

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Developing Global Teamwork Skills: The Runestone Project

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Abstract—

Runestone is a collaborative course currently offered by Universities in Sweden, Finland, USA, and China. The course provides a unique opportunity for third year engineering students from a variety of programs to experience the opportunities and challenges that international teamwork involves. Teams composed of students from two countries work intensively over a 13 week project cycle to develop a system which allows a remote user to control a lego NXT robot. The teams negotiate the features of their final system with the academic supervisors from the three participating Universities, propose a development timeframe and deliverables, and develop and demonstrate a prototype system.

This paper describes the instructional design of the course and, drawing on relevant literature in teaching and learning theory, discusses the course's intended learning outcomes, how the outcomes are fostered throughout the course, and how assessment is conducted. We also discuss the evolution of the course over the past 12 years from a pilot version with eight students from two universities to a large course with sixty to eighty students from universities distributed over three continents with very different educational and social cultures.

INTRODUCTION

Designing learning situations that help develop professional engineering skills such as teamwork, cultural awareness, and project management is a key area in educating the next generation of engineers [1]. Part of our approach to addressing these educational challenges in the IT programme at Uppsala University is the "Runestone Project", a collaborative course in engineering systems development spanning multiple Universities and cultures.¹

Runestone students complete a role and skills evaluation exercise in week one and are placed into teams by the instructors. Teams have approximately six members from two sites, and are supervised by one of the teaching team, with whom they have regular virtual meetings throughout the course. Assessment and mentoring of the teams occurs in the virtual meetings. Staff and students do not meet physically during the course, indeed many of the students might be in another country than the staff member supervising their team.

Runestone engages students in three areas; (1) Technical systems development; (2) Cross cultural teamwork and communication skills; (3) Project management, design, timeframe estimation, and progress

tracking. We assess each of these areas with approximately equal weight.

Technical

Teams are to develop a software system which allows a user to control a remote device through an interface rendered in a standard web browser window. The specification has undergone several revisions over the twelve years we have been running the project, but the salient characteristics and their relationship to learning outcomes and assessment policies has remained largely unchanged for the last ten years.

The current task requires teams to design and implement a software system which allows a remote user to control a LEGO NXT robot (of their own design) in real time through a web browser Graphical User Interface (GUI).

Teamwork

Teamwork and the process of collaboration is closely observed during the project and the teams are required to report regularly. Development of written communication skills is through critique of the bi-weekly reports the teams present. Each report is presented using online synchronous chat communication, this allows the instructors to look at concise communication skills, ability to organise and use time effectively, as well as observe the internal team social dynamic.

Project Management

Problem analysis and specification documents are requested early in the project and critiqued, they also form the foundation of part of the final team grade. Teams are asked to provide an implementation timeline in the form of a "Gantt Chart", in which the major sub-project dependencies should also be identified. This chart provides the basis for assessing the team's ability to accurately estimate time requirements, and adjust workflows as time mis-estimations become apparent during the project.

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¹ The course is a collaboration between Uppsala University, Sweden, Grand Valley State University, MI, USA, Rose-Hulman Institute of Technology, USA, Tonji University, Shanghai, China, and bo Akademi University, Finland.

Technological Development, Sustainability: Discussions about International Aspects of Engineering Education

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Abstract — Engineers are among the main agents of promotion of development in the world and the formation of a new kind of engineer is the priority to face the future economical and political market. Nations are recognizing the importance of engineers once they are the ones that make possible the world goes round. Engineering Schools worldwide have implemented more flexible programs, more investments in labs and equipments, promoted more exchanges programs and so on. It is the education evolution in order to adequate the formation of engineers of the 21st. Century. This work discusses an important issue as the engineer formation under the perspective of the international academic midst. COPEC – Council of Researches in Education and Sciences has a history of action in engineering education, conceiving and implementing projects with success. However, more and more it is necessary the permanent attention to the changes in world scenario concerning the political, economical and social aspects of the country and the globe. This awareness helps to develop and implement new programs in order to form the engineer for tomorrow. Although it is not an easy task it is the way to assure the future of engineering as well as the development of science and technology.

Keywords: *Global thinking; local awereness; contemporary paradigm; sciences sdvancement; generalist formation; strong ethics.*

SUMMARY

Now more then ever engineers should pay attention to what is going on worldwide to go for international experiences to improve personal skills and get different opportunities because nothing has more impact than personal experience [01]. There is a need to break up the old paradigm of education that perpetuates the mere technocratic formation. Although a little slowly the changes will have to happen in order to attend the demands of the 21st. Century [02]. The Council of Researches in Education and Sciences – COPEC is constituted by scientists of the several areas of human knowledge committed with education and the development of science and technology. Its members believe that education is the main beam in the construction of a better society and that science and technology are the big agents in the fostering of progress to promote the welfare of human being.

Education must promote the natural ability of the mind to set and to solve problems and by inter-relation to stimulate the full usage of general intelligence [03]. University mission is essentially the conservation of cultural inheritance generating ideas, values and knowledge. This same University has to defeat the challenge of present world serving the contemporary society viewing the future.

With the goal to defeat this challenge COPEC has implemented many projects in different Engineering Schools that were very challenging. They were programs that required the full commitment of the school team. Others that required substantial financial investment in new equipments but all of them were accomplished with success [04]. Besides the programs COPEC has implemented some other projects to foster the formation of the new engineering. They are projects designed to serve engineering students of any engineering school of the region. The objective is to offer opportunities for students to get better experiences and enrich their formation, such as: The Engineering Educator Graduation Program; The Port Engineering Program; Study Abroad In Brazil and Abroad.

All the programs and projects of engineering education that were implemented showed that it is possible to innovate and change the formation of engineers and so to provide them the tools that they will use as professional and as researcher. The majority of the programs developed by COPEC Team of education were implemented in different Universities in the region, which has 9 universities.

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Session: 05F LiLa Special Session: Library of Labs - LILA Project

Deployment of Remote Experiments: The OnPREX course at the TU Berlin
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Federated authentication and authorization for reusable learning objects
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Nano-World A Showcase Suite for Technology-Enhanced Learning
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**Generalization of an Active Electronic Notebook for Teaching Multiple
Programming Languages**
Fritzson, Peter;Pop, Adrian;Torabzadeh-Tari, Mohsen
Linköping university (Sweden)

**Delivering authentic experiences for engineering students and professionals
through e-labs**
Bhave, Amit;Braumann, Andreas;Coble, Aaron R.;Kraft, Markus;Smallbone,
Andrew;Watson, Roger
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Simulations in Undergraduate Electrodynamics
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Deployment of Remote Experiments

The OnPReX course at the TU Berlin

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Abstract— The development of internet technologies leads to recent trends of online based education in universities. Remote experiments give the students the possibility to experience real physical situations and compare their experimental results with those of the physical models (simulation). Online learning based on remote experiments is capable of diminishing the scantiness in practical courses in the universities. In this work we present an online practical course based on Remote Experiments (OnPReX), interactive graphics and an online tutoring system organized at the Technische Universität Berlin. Furthermore we give background information about the development of our remote experiments. The remote experiments are real-life settings, designed and engineered at the solid-state physics department of the Technische Universität Berlin. We describe the development of two online practical courses, focusing on classical and modern physics, addressed at undergraduate engineering students. We ran the online practical course based on Remote Experiments in two test phases over two semesters and conducted an evaluation from which we improved technical and pedagogical aspects of the experiments and the course.

Keywords- Remote experiments; online tutoring; online course; Physics in engineering education

SUMMARY

At the Berlin Institute of Technology there are more than 500 students in an undergraduate physics course. In the learning process of physical phenomena elements of physics theory, physics models and practical experiments must be involved. Often theory, models and experiments are offered separately, with time shifts in the curriculum, leading to a discontinuity in the learning process. Also there is a set of physical experiments not included in physics curricula, because they have a unique or expensive setup (e.g. Raman spectroscopy). Some other experiments are too dangerous to be conducted by beginners (e.g. the experiments with radioactive sources). Due to the lack of possibilities to provide a practical course for these students

we organized an online practical course based on Remote Experiments (OnPReX). Our Online practical course is a combination of the remote experiments with an e-learning software platform called Moodle [1]. Remote experiments are real-life settings, built up at the TU Berlin and connected to a PC. We named this setting Remote Farm [2]. These computers are also used as web servers, so everybody can get access to the experiments through a free browser plug-in and gain control over all devices. All data recorded during the experiment is stored online and is accessible for users. The course schedule can be explained briefly as following. After studying the fundamentals of physical phenomena the students perform the experiments in small groups with the help of available literature and an online tutoring system in an online learning platform (ISIS) [3]. The acquired data can be evaluated and analyzed with suitable data processing programs. The reports have to be sent for correction via email to a lecturing tutor. The OnPReX participants have, due to the online character of OnPReX, the possibility to take part in the practical course at any time and anyplace. Khachadorian et al. [4] showed that the OnPReX course matches with the authentic online learning environment characteristics explained by Herrington et al. [5].

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Federated authentication and authorization for reusable learning objects

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Abstract— The LiLa (Library of Labs) project goal is to combine virtual laboratories and remote experiments spread out over Europe, which will be shared and exchanged among educational institutions in the form of reusable learning objects. This work addresses the needs of authentication and authorization when reusable learning objects are exported from an *experiment provider* organization to an *experiment user* Learning Management System. The paper discusses possible solutions based on using the SCORM run-time environment specification as a framework for learning objects and Shibboleth as a framework for a federated authentication and authorization.

Keywords—virtual laboratories; remote experiments; authentication; authorization; learning objects

SUMMARY

The LiLa (Library of Labs) project goal is to combine virtual laboratories and remote experiments (i.e. simulated experiments and experiments which are controlled remotely by computers) spread out over Europe, making them reachable in an environment with central retrieval and access facilitating synchronous collaboration and user generated production.

The project includes the design and deployment of a technical framework in which virtual laboratories and remote experiments can be shared and exchanged among educational institutions in the form of reusable learning objects. In this context, there is a need to provide authentication and authorization mechanisms when these reusable learning objects are shared or exchanged, among other reasons because they can be an entry point to external resources (the remote laboratories) whose access will need to be controlled or restricted. This work addresses these needs of authentication and authorization when

reusable learning objects are exported from an *experiment provider*, that is, an experiment repository or a LMS (Learning Management System) of an institution providing access to resources for virtual laboratories or remote experiments, to an *experiment user LMS*, that is, the LMS of an institution which includes the learning objects as part of the curriculum for its students.

The software architecture used in LiLa requires that the virtual laboratories and remote experiments are provided as LiLa Learning Objects (LLO), which are an special SCORM encapsulation [1] including access control functionality for interacting with the Virtual Portal authentication components in order to force that the experiments are only executed by the adequate authorized students. The objective is to enforce access control to the experiments provided by LLOs not only when LLOs are deployed on the Virtual portal, but also when they are deployed on external LMSs, taking advantage of the functionalities offered by the Shibboleth system [2], that allows to build a federated authentication and authorization infrastructure for web applications.

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This work was partly funded by the eContentPlus EU project ECP-2008-EDU-428037 'LiLa' (Library of Labs: Dissemination of Remote and Virtual Laboratories for Natural Sciences and Engineering).

Nano-World

A Showcase Suite for Technology-Enhanced Learning

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Abstract— Over the past couple of years we have defined and implemented a variety of tools and instruments for supporting technology-enhanced teaching within the field of Nanoscience. Among others, the Nano-World showcase suite developed includes the following: a collaborative simulator for learning the basics of atomic force field microscopes; a remote laboratory which offers real-world access to experiments at the nanoscale level; software infrastructure for remote control and steering of ongoing experiments using mobile devices; interactive courseware that teaches the basic laws of physics such as force fields; a web-based platform for 3D visualizations of data collected via nano microscopes; and an interactive game for getting first impressions of atomic manipulations.

In the paper we describe the different components and report on lessons learned from using the showcase within the university curriculum as well as an information medium for schools and public audiences. We also report on plans and first steps to interface the showcase suite with LiLa – the forthcoming library of labs.

Keywords: Remote Laboratory, Virtual Experiments, Nanoscience, 3D visualization, Collaborative Learning Environments



Figure 1. Youngsters making their first manipulation experiments at the nanoscale level. Three interconnected Nanojoystick stations were presented at the Sciencedays in Rust, Germany, attended by nearly 20,000 prospective students.

SUMMARY

Nano-World demonstrates how the Nanoscience curriculum can be enriched through the use of advanced learning technologies. The simulation of experiments makes them much more accessible to students. Simulated experiments are much cheaper, can be repeated arbitrarily and require less prior knowledge than real experiments. Students can train under conditions that they will later experience in their real lab work.

Accessibility not only on a technical, but also on a conceptual level is facilitated through the use of advanced visualization and interaction techniques. Nano3D allows students and researchers to explore their measurements in three-dimensional representation. The high-end nature of the visualization makes Nano3D a valuable tool not only in exploration and interpretation, but also in publishing about the experiments. The Nanojoystick is focused more on prospective students and aims at providing a playful and intuitive access to the world of nanostructures (see Fig. 1). Experience from public events shows that the Nanojoystick is well suited for providing an interactive entry point for children in small groups. Finally, NanoMobile is a valuable tool for overcoming the restrictions that long-time experiments impose on collaboration and freedom of the supervisor. Through NanoMobile, students and scientists can monitor and control experiments collaboratively and completely independent of their location.

In a broader perspective, the most important feature of the Nano-World suite is virtualization. First, real-world experiments are virtualized in simulations. Second, the presence of users is virtualized through networked communication technologies. The result of the virtualization is a much broader availability of experimental and collaborative tools. An interesting challenge is the bringing together of the developed approaches in a single virtual space. This is the goal of the LiLa (Library of Labs) project [1].

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Generalization of an Active Electronic Notebook for Teaching Multiple Programming Languages

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Abstract — In this paper we present a generalization of the active electronic notebook, OMNotebook, for handling multiple programming languages for educational purposes. OMNotebook can be an alternative or complementary tool to the traditional teaching method with lecturing and reading textbooks. Experience shows that using such an electronic book will lead to more engagement from the students. OMNotebook can contain technical computations and text, as well as graphics. Hence it is a suitable tool for teaching, experimentation, simulation, scripting, model documentation, storage, etc.

OMNotebook is part of the open source platform OpenModelica. It is already used for the course material DrModelica in teaching the Modelica language but can easily be adapted to other programming languages which is also shown in this paper. The notebook can also be adapted to other areas, such as physics, chemistry, biology, biomechanics etc., where phenomena can be illustrated by dynamic simulations within the notebook.

The idea behind this paper is to show that by using a standardized interface the notebook can be extended to any computer language, i.e., being language independent. This is shown in the form of an implementation and adaptation of the notebook to support the Scheme language.

Keywords- *OpenModelica, Scheme, DrModelica, Electronic Notebook*

I. SUMMARY

In this paper we introduce a research project for generalizing the modern object-oriented equation-based modeling and simulation environment OpenModelica towards supporting other programming languages than Modelica, [1]. In this way the active student has a common platform for learning programming languages as well as given the opportunity to experiment with physical phenomena by using an interactive electronic book, OMNotebook, [2].

The OpenModelica Notebook editor, OMNotebook, provides an active electronic notebook including an editor. This interactive E-book, OMNotebook, has been used successfully in both graduate and workshop courses for the Modelica language. The notebook is active in the sense that models inside the book can be changed and executed, it is not just a passive textbook or HTML page. This is one of the first open

source efforts that makes it possible to create interactive books for educational purposes in general, and more specifically for teaching and learning programming. This functionality allows the usage of interactive hierarchical text documents where underlying chapters and sections can be represented and edited. OMNotebook supports functionality for OpenModelica model simulations, text, images and interactive linking between those which makes it possible to use it for teaching applied sciences in physics, human biology, mathematics and computer science.

The hierarchical structure of traditional documents, e.g. books and reports, can also be applied to the notebook which basically means that the book is divided into sections, subsections, paragraphs, etc. This makes navigation among the book sections easier.

In the OMScheme extension of the OpenModelica platform the interactive notebook has been further developed and adapted to the Lisp dialect, Scheme, [4], for creating a suitable educational environment, where students don't have to focus on different technologies but instead focus on the information. With this extension Scheme programs can be evaluated taking this idea further, combining an additional programming language with innovative teaching concepts.

The interactive session handler interface in the OpenModelica platform is used in this paper for communication between the OM Notebook and the Scheme interpreter.

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Delivering authentic experiences for engineering students and professionals through e-labs

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Abstract—Use of industrial technology in ‘remote experiments’ and ‘virtual labs’ delivers authentic experiences to students. Both of these resources can be shared between universities or industrial partners, reducing development, operation and maintenance costs versus traditional labs. We compare remote experiments and virtual labs, using two case studies: ‘Cambridge Weblab’, a remote experiment built at the University of Cambridge, and ‘SRM web-suite’, a virtual lab developed by CMCL innovations. The Cambridge Weblab uses a Siemens industrial interface to control a chemical reactor, yielding authentic experiences of industrial practices for students. The SRM web-suite uses an advanced engine-design tool that simulates fuels, combustion and emissions in conventional and advanced internal combustion engines. The web-suite labs provide students and professionals experience using industry-standard technology and support educational goals ranging from basic courses in combustion engines to advanced courses in futuristic fuels. We assess the potential impact of these learning resources within the pan-European Library of Labs (LiLa) framework and demonstrate that remote experiments and virtual laboratories are complementary, that there is significant potential for integration of the two, and that both can benefit from the latest industrial technologies.

Keywords- *Library of Labs (LiLa); remote experiments; virtual laboratories; chemical process control; advanced combustion engines*

SUMMARY

We compare three types of laboratory in higher education.

- conventional labs: students are physically present and interact with equipment directly.
- ‘remote experiments’: students are not physically present, but interact with real equipment via a software interface, typically over the internet.
- ‘virtual labs’: use software to simulate physical phenomena and do not require lab equipment.

Remote experiments and virtual labs are collectively termed ‘e-labs’. E-labs are increasingly used in higher education [1] due to financial, spatial, and safety requirements. They also support experiments otherwise too difficult or dangerous for

undergraduates. Trial & error learning, familiarity with equipment and authenticity have been problematic for e-labs, but solutions now exist. Conventional labs, remote experiments and virtual labs are complementary tools, as shown by the case studies on the ‘Cambridge Weblabs’ and the ‘SRM web-suite’.

The Cambridge Weblabs [1] comprise a series of remote experiments using a Siemens SIMATIC™ PS7 industrial interface and automation hardware to control a chemical process in a stirred-tank reactor. The apparatus has been used for experiments on chemical reaction engineering and process control. The former requires significant preparation and a strict procedure, while the latter requires little preparation and allows students more freedom. Feedback suggests that the Weblabs provide similar student learning outcomes and satisfaction levels to conventional labs. The SRM web-suite [2] is a series of virtual labs based on CMCL Innovations’ engine modelling software. By using real industrial software, the web-suite delivers a more authentic experience than most virtual labs and the equivalent conventional lab would be too expensive and time-consuming to run in an educational setting. New teaching materials are being developed for the web-suite using ‘productive failure’ pedagogy. This ‘trial and error’ approach is not usually possible in conventional labs due to access limits.

The case studies show that many stereotypes of e-labs are outdated; remote experiments can provide an exciting user interface and virtual labs can be authentic and industrially relevant. The future of the Weblabs and the SRM web-suite depends on ease of access and institutional sharing. Both e-labs will be integrated into Library of Labs (LiLa), an online community dedicated to e-labs throughout the EU. LiLa will help teaching staff share learning resources and expertise, encouraging integration into curricula and sharing of e-labs.

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Simulations in Undergraduate Electrodynamics: Virtual Laboratory Experiments on the Wave Equation and their Deployment.

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Abstract—Experiments play a vital role in undergraduate engineering education: They allow students to learn the foundations of engineering in practical hands-on courses. However, lack of funding and increasing costs for equipment makes it harder and harder to supply a complete pool of experiments for large student classes. The EU funded “Library of Labs” project aims to counterbalance this development by creating a EU wide network of remotely controlled experiments and virtual laboratories. Remote experiments are here real experiments remotely controlled over a network, virtual laboratories simulation environments using the component metaphor of a real laboratories.

In this paper, we introduce such a virtual laboratory developed at the University of Stuttgart; the aim here is to help students, here participating in the undergraduate physics course for engineers, understanding abstract phenomena by visualizing the underlying mathematics. We demonstrate this in a particular use-case, the wave equation and phenomena related to it, as they are discussed in undergraduate physics, and show how to implement this as a simulation in the virtual laboratory.

In cooperation with the physics department a deployment plan for this experiment and related experiments has been created for the lecture “Physics for Engineering” which shall also be presented and discussed.

OVERVIEW

Due to the recent change to the Bachelor/Master program in Germany, many foundational courses in the Bachelor program had to be streamlined and shortened. As a consequence of this streamlining, courses as fundamental as elementary experimental physics for engineers have been cut down from two to only one semester, and no time is left in these courses to provide students access to practical laboratory hands-on courses in the first semester. The first time students do have contact to real labs is delayed to the second semester where admission to the labs is granted by passing the exams in the first semester. Theoretical background is taught first, followed by practical hands-on courses allowing students to get in touch with practical aspects; the gap between theory and practical applications is here rather extreme, lots of background is simply forgotten in six month.

In reaction to these deficiencies, Schauer introduced an alternative strategy based on integrated e-Learning, defined as “interactive strategy of teaching and learning based on the observation of the real world phenomena by the real e-experiment and e-simulations”. The procedure here is first to observe

the real world phenomena, search for proper information, collect and evaluate data, then present and discuss data and results. Only then comes the explanation and the mathematical formulation of generalized laws and their consequences. The advantage of this procedure is that students have to take an active part in the teaching process.

Building a pool of experiments sufficient to cover all of undergraduate physics is of course not an easy concern either, and a rather overwhelming task for a single university. To this end, the University of Stuttgart and ten other European institutions formed the “Library of Labs” network, supported by the eContentplus programme of the European community. The aim of this network is to setup a common infrastructure to mutually grant access to and share lab experiments and simulations available at the partners, and thus gain access to a sufficiently large pool while sharing the costs and the infrastructure.

In this paper, we describe a Virtual Laboratory deployed at the University of Stuttgart whose aim is to provide simple, computer based experiments for first year Bachelor students in the field of engineering. Unlike remote experiments — also part of LiLa — virtual experiments are only computer based. A virtual laboratory is here defined as a software framework that allows to design, setup and perform experiments implemented by computer algorithms; unlike a simulation, virtual laboratories provide a flexible framework for many simulations at once and are freely programmable. As an example, we will discuss experiments on the wave equation. Some light will be shed on the mathematical background, on their implementation in the virtual laboratory and last but not least on their application in undergraduate physics courses. We give specific guidelines how such experiments are — in our opinion — most successfully deployed, and report on our findings.

Session: 05G e-Madrid Special Session- eMadrid: Research and Development of e-Learning Technologies in the Madrid Region

Some Research Questions and Results of UC3M in the E-Madrid Excellence Network

Crespo, Raquel;de-la-Fuente, Luis;Delgado-Kloos, Carlos;Gutiérrez-Rojas, Israel;Ibáñez, M^a Blanca;Leony, Derick;Muñoz-Merino, Pedro;Muñoz-Organero, Mario;Pardo, Abelardo

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An approach for Description of Open Educational Resources based on semantic technologies

Chicaiza, Janneth;López, Jorge;Martínez, Oscar;Nelson-Piedra, Nelson;Tovar, Edmundo

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<e-Adventure> Introducing Educational Games in the Learning Process

del-Blanco, Ángel;Fernández-Manjón, Baltasar;Marchiori, Eugenio J.;Moreno-Ger, Pablo;Torrente, Javier

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Influence of Libre Software in Education The blogs planet case

González-Barahona, Jesús M.;Gregorio, Robles
Rey Juan Carlos University (Spain)

Automatic Guidance Tools for Enhancing the Educative Experience in Non-Immersive Virtual Worlds Preliminary results from project V-LeaF

Camacho, David;Pulido, Estrella;Rico, Mariano
Autonoma University of Madrid (Spain)

Enhancing Authoring, Modelling and Collaboration in E-learning environments: UNED research outline in the context of E-Madrid excellence network

Bárcena, Elena;Castro-Gil, Manuel Alonso;Delgado, José Luis;Lorenzo, Emilio J.; Martín, Sergio;Mayorga, José I.;Pérez-Molina, Clara;Read, Tim M.;Rodrigo, Covadonga;Rodríguez-Artacho, Miguel;Ros, Salvador;Vélez, Javier

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Some Research Questions and Results of UC3M in the eMadrid Excellence Network

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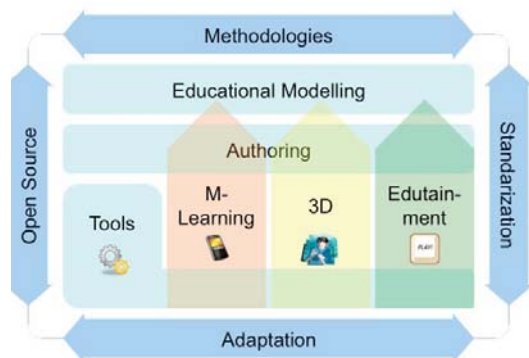
Abstract— Universidad Carlos III de Madrid is one of the six main participating institutions in the eMadrid excellence network [1], as well as its coordinating partner. In this paper, the network is presented together with some of the main research lines carried out by UC3M. The remaining papers in this session present the work carried out by the other five universities in the consortium.

Keywords- e-learning, technology enhanced learning

SUMMARY

eMadrid [1] is the name of the Excellence Network about e-learning funded by the Regional Government of Madrid. Its members are the Universidad Carlos III de Madrid (UC3M), who acts as a coordinator, Universidad Autónoma de Madrid (UAM), Universidad Complutense de Madrid (UCM), Universidad Politécnica de Madrid (UPM), Universidad Rey Juan Carlos (URJC) and Universidad Nacional de Educación a Distancia (UNED), together with a large number of associated companies and educational institutions. The aim of the network is to provide leadership and perform advanced research in the area of e-learning.

Although the research to be carried out is intertwined and related, the consortium has organized its work around the following research lines: (1) Educational modelling (including collaboration & virtual communities), (2) Educational methodologies based on ICT, (3) Standardization of tools and educational content, (4) Platforms and tools for e-learning, (5) Adaptation, adaptability, and accessibility, (6) Immersive 3D learning, (7) Edutainment (Integration of games and simulations in Virtual Learning Environments), (8) M-learning (Mobile and ubiquitous learning), (9) Authoring & Applications of Web 2.0 and Web 3.0 to e-Learning, and (10) Free and Open Source Software. This figure shows the relationship among them:



We distinguish 3 main phases in the educational process: the phase of educational modelling, where the learning process is planned, the authoring of the needed learning material and assessment, and finally the tool-based deployment and enactment. For each of these main phases, we have one research line. But apart from the mainstream application areas, there are 3 promising areas, which deserve particular attention. These are m-learning, 3D virtual worlds, and game-oriented learning, which cut across the main areas. Due to their future importance, we study them in detail in independent research lines.

All this is framed by educational methodologies (giving a pedagogical underpinning to the learning process), standards (enabling interoperability among tools), adaptation in the most general sense (to classes of users and their abilities and context), and development principles (among which we concentrate on open source).

This paper is the first in a special session about the eMadrid excellence network. It presents the research lines in the area of e-learning carried out at UC3M. The remaining 5 papers in this special session are written by the other consortium partners and touch upon several of the research lines mentioned above.

ACKNOWLEDGMENT

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An Approach for Description of Open Educational Resources based on Semantic Technologies

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Abstract—Open Educational Resources are accessed through the web, whose real setting shows an explosion in the use and development of tools and services based on Social Software. However, the growth of this data repository makes it difficult to find information of value, and reduces the possibilities of sharing and exchanging resources. Using semantic technologies to describe educational resources enables any agent (human or software-based) to process and understand its content (applying inference rules on more structured knowledge). Metadata standards can be used to annotate educational resources; they facilitate their interoperability and discovery. In this work, we propose, OER-CC ontology, for the description of Open Educational Resources under Creative Commons Licenses. This approach is based on standard technology and metadata standards. The ontology could be utilized in higher education institutions (and organizations) to facilitate sharing and discovery of their digital content.

Keywords—component; Emerging technologies, Education, Knowledge modeling, Metadata

OER-CC ONTOLOGY

Open Educational Resources are accessed through the web, whose real setting shows an explosion in the use and development of tools and services based on Social Software. However, the growth of this data repository makes it difficult to find information of value, and reduces the possibilities of sharing and exchanging resources.

Using semantic technologies to describe educational resources enables any agent. Metadata standards can be used to annotate educational resources; they facilitate their interoperability and discovery.

In this paper, we propose, OER-CC ontology, for the description of Open Educational Resources under Creative Commons Licenses. This approach is based on standard technology and metadata standards. The ontology could be utilized in higher education institutions (and organizations) to facilitate sharing and discovery of their digital content.

This document is divided into 3 sections. The first section introduces the models and OERs drivers and we put forward options for incorporating semantic technologies in OERs

description. Next, development process of OER-CC ontology is described. In the last section, we describe the recovery process of knowledge represented in ontology.

A. Description of Open Educational Resources by mean of Metadata and Ontologies

For the learning materials “these various standards and specifications have been developed to meet different requirements and to support the needs of different communities” [1]. By other hand, an ontology unlike other knowledge structures (e.g. library classification or thesaurus), it allows applying logic, inheritance and other issues [2].

B. Development of OER-CC Ontology

For OER-CC ontology development, we have used; (i) tools such as, Protégé (one of the most popular ontology editors), Cmaptools (to build interconnected concept maps) and Cmaptools Ontology Editor Cmaptools (includes features oriented towards the expression of formalized ontologies); and (ii) languages such as, OWL (W3C recommendation), SWRL (to provide deductive reasoning capabilities) and SPARQL (to retrieve the educational resources metadata). Each tool and language was applied at different stages of ontology development. This process is based on the guidelines suggested by METHONTOLOGY (methodology considered as the most mature and complete).

C. OER-CC Ontology Instantiation and Retrieval

To instantiate the OER-CC ontology, we considered some resources generated in the Computer Science School (CSS) of the Universidad Técnica Particular de Loja (UTPL), Ecuador. Some queries were designed to extract information from OER-CC ontology, geared mainly to determine its use in tasks of recovery, accessibility and OERs remix.

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<e-Adventure>

Introducing Educational Games in the Learning Process

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Abstract— Within the last years educational games have attracted some attention from the academic community. Multiple enhancements of the learning experience are usually attributed to educational games, although the most cited is their potential to improve students' motivation. In spite of these expected advantages, how to introduce video games in the learning process is an issue that is not completely clear yet, which reduces the potential impact of educational video games. Our goal at the <e-UCM> research group is to identify the barriers that are limiting the integration of games in the learning process and propose approaches to tackle them. The result of this work is the <e-Adventure> platform, an educational game authoring tool that aims to make of video games just another educational tool at the disposal of the instructors.

Keywords--<e-Adventure>; educational games; authoring tool; LAMS

SUMMARY

Instructors, parents and public authorities are astonished by how dropout rates have grown in education at all levels for years. This alarming trend suggests a drastic decrease in the motivation of the students towards learning.

Several hypotheses have been formulated to explain this controversial issue. In this line, authors like Prensky [1] argue that there is a clear disconnection between students' expectations and what they receive in the classroom. According to Prensky, current students are *digital natives*, people used to interact with rich interactive digital media such as computers, mobile devices or video game consoles; this differs from the typical pedagogical strategies in terms of content and interaction [1, 2].

To tackle this issue, a deep reform should come to the educational system, updating the content and interactivity used to support learning. One of the proposals is the use of video games and other kind of interactive technological content. Actually, the application of games in education is a trend on the rise. There is a belief that video games have potential to enhance the learning processes in multiple ways. One of the most frequently discussed is the ability that games have to increment students' motivation towards learning as they are able to capture their attention and keep them engaged and immersed [3, 4]. Other interesting traits of educational video games is that they provide immersive in-game worlds that can

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be explored freely by the students, promoting self-directed learning, their short feedback cycles with perception of progress, or their relation to constructivist theories and support of scaffolded learning [5, 6].

This interest in the use of educational video games laid the basis for the <e-Adventure> project [7]. <e-Adventure> (<http://e-adventure.e-ucm.es>) is a platform that has been developed by the <e-UCM> research group at the Complutense University, and its main aim is to facilitate the introduction of the games in the learning process. Nonetheless, to achieve this goal several barriers have to be tackled first. Between the most relevant issues we find the high development cost of video games, the difficulty of involving instructors in their development, and the complexity of embedding the games in traditional pedagogical approaches. After that we describe how these issues have been addressed in our proposal, the <e-Adventure> platform.

As <e-Adventure> has become a robust product, now it is a great test-bed where we are implementing our new work on educational games. In this paper we also include a discussion about the main research lines we are working on, including the integration of <e-Adventure> in the LAMS [8] e-Learning environment, the consideration of accessibility issues in <e-Adventure>, or the development of a new authoring tool for the creation of story-driven educational games.

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Influence of Libre Software in Education

The blogs planet case

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Abstract—Libre (free, open source) software brings new opportunities, but also new troubles, to the education experience. It provides a great deal of new tools that can be used unexpensively and easily. On the opportunities side, it enables customization and adaptation to special needs, and full reproduction of educational experiences without depending on a budget for expensive software licenses. But it also brings the troubles of charting a new territory, maintaining applications in a demanding environment, and finding ways of adapting to specific needs.

In this paper, we introduce these issues by analyzing a practical case study which has been run in real classes during several years: the contribution by students to a "planet" ("blog of blogs") with topics related to an educational subject.

Keywords—open source; free software; libre software, education, blogs, planets;

SUMMARY

Blogs have become mainstream during the last decade, dealing with topics ranging from politics to technology. They are run with a great variety of objectives, from activists trying to publicize their opinions to corporations trying to become closer to their customers. Blogs have also been used for educational purposes, for example as a source of information for students, or as a way of presenting assignments and summaries of class work. Currently, most learning management systems include blogs as an integral subsystem.

Planets are websites which aggregate (syndicate) content from different blogs as if they were a unique blog. Blogs usually offer their content in some XML-based format (RSS, Atom...), known as the *feed* of the blog. Feeds can be accessed by means of a public URL. The planet software downloads feeds corresponding to the syndicated blogs and aggregates them in inverse chronological order as if all the stories would belong to a single blog.

Planets help in the creation of a community, as the mostly personal views of contributors are grouped in a single location

for each project. Informal, and sometimes personal or not-project related information is shared among the members of a project, offering new points of view and stimulating discussion and innovation.

Although planets have been used by the libre software community for some years now, there is little use of them in the educational community.

This article presents a teaching experience of e-learning based on the use of a planet of blogs that has been augmented with functionality that allows students to evaluate the stories of their classmates. To do this, students had to create a blog for writing stories with content related to the subject. The contents of all the student blogs were linked into a planet, the central location where they can be read and commented. The experience presented refers to six subjects of non-technical degrees. Of these six subjects, one was on-site and the other five were complete distance learning experiences. All courses were related directly or indirectly to computers, information technologies, computer networks and free culture, but none of them was purely technical. The total number of students who have participated in them is around 350.

A methodology for using planets in e-learning environments is described, along with some lessons learned from several experiences of use.

In summary, the procedure, as perceived by the students, is as follows. Each student has to create a blog specific for the subject. All student blogs are linked from a centralized location, the planet. Students will be able to positively rate entries from blogs of their peers that they believe provide useful information for the subject.

From the point of view of the educator, some important aspects are: information to the students about how to use blogs, and how to grade contributions by other students; follow-up of topics addressed, and their originality; proper way of citing external work; and general fine tuning of the experience (number of entries per student, adjustment of grading, etc.). The evaluation of the activity is partially done based on the gradings of their peers, by the students themselves.

Automatic Guidance Tools for Enhancing the Educative Experience in Non-Immersive Virtual Worlds

Preliminary results from project V-LeaF

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Abstract— The interest of the Education community for Virtual Reality (VR) technologies has increased in the last few years due to their attractive 3D immersive worlds and facilities to provide a good environment to develop educational and collaborative tasks. However, these technologies present three main drawbacks: (1) a high cost in terms of hardware and infrastructure, (2) a high level of technology knowledge, and usually programming skills, is required to build up an educational and functional platform, and (3) once the educational platform is available for use, the educators are limited to the functionalities provided by the platform used. Our previous experience, designing and deploying a VR educational platform, named V-LeaF, showed that non immersive platforms (close to the gaming 3D platforms) provide High School educators and students with an attractive environment in which many features of the teaching/learning experience can be explored. However, this technological strength appears as a potential weakness feature of our platform when is used by high school students. Serious problems to maintain the student attention in this kind of domains have been detected, so the educators must employ time and dedication to ensure that students are really attending and acquiring the educational concepts scheduled. In this paper we describe an initial set of software tools developed (for both teachers and students) to solve the previous problem. An eye-gaze monitorization device allows teachers to focus the students' attention. A forms-based recommender system allows students to guide teacher's activity.

Keywords: *Virtual worlds; Virtual reality; Education; Recommender systems; Opensim*

SUMMARY

The V-LeaF platform is a VR educational platform built on top of the OpenSim platform (a non-commercial version of Second Life) which aims at enhancing the teaching and learning experience. The use of this platform has showed that non immersive platforms (close to the gaming 3D platforms)

provide high school educators and students with an attractive environment in which educational and collaborative tasks can be developed. These platforms do not require educators to have a high level of technology level nor programming skills. In addition, unlike traditional educational platforms, educators are not limited to the functionalities provided by the specific platform.

When used by high school students, this kind of platforms presents the drawback of maintaining the student attention. This means that educators must employ time and dedication to ensure that students are really attending and acquiring the educational concepts as scheduled.

In this paper we describe an initial set of software tools developed (for both teachers and students) to solve the previously described problems. An eye-gaze monitorization device allows teachers to monitor the "attention-level" of students in a non-intrusive way.

In addition, a teacher evaluation module allows educators to adjust their explanation speed to students' knowledge level by prompting students with questions about the teacher's activity. A web application is used to configure different parameters such as the list of questions or the number of minutes between questions.

With the aim of evaluating the utility and effectiveness of both mechanisms, a set of experiments have been carried out with high school students and educators which show that work in this direction could be useful.

Although the V-LeaF platform is initially oriented to high school students and teachers, it has a wider application scope since any social task involving avatars can benefit from the used of the platform.

This work has been funded by the Spanish Ministry of Science and Innovation under the projects V-LeaF (TIN2008 - 02729 - E/TIN) , METEORIC (TIN2008-02081) and e-Madrid (S2009/TIC-1650).

Enhancing Authoring, Modelling and Collaboration in E-learning environments: UNED research outline in the context of E-Madrid excellence network

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Abstract— In the last years, authoring based on e-learning standards has been consolidated as a core factor of industry and development of interoperable and effective virtual learning environments. However, there is a need for further research on abstraction to provide a more instructional view in the context of authoring tools in a variety of ways, in order to avoid being driven by Learning Technology (LT) specifications, facilitate instructional knowledge aggregation, and to provide an appropriate level of clarity and semantics in the design of collaborative activities. We propose a combination of techniques to provide this instructional abstraction in the context of the new European educational model, combining instructional layers and collaborative scripts in authoring tools, and semantic web techniques for extending e-learning material in order to harness the wealth of existing web content and semantically labeled repositories.

Keywords: *E-learning content modeling, Educational authoring, collaborative learning, e-learning standards, Semantic web*

SUMMARY

The generation of educational content and design of collaborative activities has always been a big effort, especially because in many occasions the objective of the author or group of authors is to reuse existing resources and develop a complete course, including complex activities with content and user interactions. If the main goal of a learning object (LO) is to be used for teaching and learning, the second one in importance should be its reuse. To this end, extensive research has been carried out in the last years to standardize learning content components and collaborative interactions [14], to make them usable in interoperable and maintainable content repositories. To organize and help in the retrieval of the right LOs, metadata labels have been defined and standardized. But this has introduced an additional burden, namely that of annotating LOs appropriately following these metadata.

In this context, gathering educational content is a matter of two factors (a) reusability, which implies to have the resource at the appropriate level of granularity, and (b) availability,

which tackles the idea of actually finding the most appropriate resource using a variety of techniques. The fact is that authoring tools usually do not implement features for these two factors and generally also lack of the appropriate abstraction level to provide an efficient way to search and retrieve content and on the other hand, a suitable way to describe learning courses at an instructional level of abstraction.

To overcome these problems in authoring of educational material we propose a combination of techniques to provide instructional abstraction by means of instructional layers, collaborative scripts in authoring tools and semantic web techniques for extending e-learning material in order to harness the wealth of existing web content and semantically labeled repositories.

Contribution of this research is to be disseminated through the E-Madrid Network of excellence, recently created and supported by the Comunidad de Madrid (Madrid Region Authorities) via S2009 TIC-1650 project and also by the Ministry of Innovation via project TIN2009 14317-c03-03, both participated by the UNED LTCS group.

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Session: 06A Area 1: Uses of Technology in the Classroom - Engineering Applications

A technological platform for teaching control engineering

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Motivating Younger Students by Using Engineering Graduation Projects to Facilitate their Work

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FPGA/Embedded system Training Kit Targeted to graduate Courses towards Industry level short training

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Educational Software Interface for Power Electronic Applications

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A technological platform for the teaching of control engineering

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Abstract— This paper presents a technology platform as a resource for the teaching of control engineering. The platform in question combines the educational potential of software of design and simulation of control systems - MATLAB® - and the connection between this software and a pilot distillation column. The research hypothesis is that the use of technology platforms such as this helps to develop aspects not only stimulated with simulation. Therefore, an experiment based on the constructivist and social-interactionist theory has been designed to detect student development and to capture their impressions of the platform. The results are presented as graphs and impression reports of the teacher.

Keywords— technological platform, control systems, constructivist theory.

SUMMARY

Emphasis on the teaching of techniques instead of concepts results in a fast forgetfulness by students. The teaching of theory detached from practical aspects does not properly prepare the student for his professional life [2].

Currently in engineering education some methods that have been used by teachers have not been contributing significantly to the development of skills and competencies necessary for professionals, particularly in a control engineering course. This paper presents a technological platform as a teaching-learning resource to the control engineering teaching.

The platform in question combines the educational value of software design and simulation of control systems, known as MATLAB® - and the connection of this software to a pilot distillation column. This connection is achieved through a network of field instruments - fieldbus, and the network communication with a PC using the protocol of dynamic data exchange OPC (OLE for Process Control).

According to [1] recommendations by the Accreditation Board for Engineering and Technology (ABET), an American institution that aims at establishing specific quality criteria for each major, undergraduate courses should encourage the ability to apply knowledge of mathematics, science and engineering; design and conduct experiments; analyze and interpret data; design a system, component or process to meet desired needs; function on multi-disciplinary teams; identify, formulate and solve engineering problems; understanding of

professional and ethical responsibility; communicate effectively (written and orally); understand the impact of engineering solutions in a global and societal context; engage in life-long learning; use the techniques, skills and modern engineering tools necessary for engineering practice.

The research hypothesis is that the use of technological platforms such as this helps students to develop relevant aspects not stimulated only with simulation. Considering that we should not evaluate the student with only one exam at the end of the teaching-learning process, an experiment was designed to verify students' progress during the semester, building on the concept of mediator evaluation. To capture students' impressions about the proposed platform and its importance in the teaching-learning process, an adaptation of SERVQUAL was used as search instrument. SERVQUAL is usually used for service quality evaluation.

The other aspect of the research related to students development, was collected in the form of impressions reports of the teacher throughout the academic semester with daily records.

Preliminary results from a pilot study are presented in the form of graphs comparing expectations and perceptions of students on the platform using. A summary of the main impressions of the teacher about students' progress about design, implementation and testing of control systems in pilot distillation column is also presented.

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Motivating Younger Students by Using Engineering Graduation Projects to Facilitate their Work

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Abstract—This paper addresses a way to motivate freshmen students benefiting from the work of term students in graduation projects. The application of concepts from digital electronics and analog telecommunications systems can reinforce cooperation of students at different levels on a positive way and strength skills. This can also be used as demonstrative experiences to attract prospective students to electrical engineering courses. The experience of a cooperative work with graduation projects is presented and how it can facilitate younger students work and thus contribute for their motivation and skills.

Keywords- *Antenna measurements; computer aided instruction; cooperative work; graduation projects; electrical engineering education*

SUMMARY

Younger engineering students often face some difficulties with working methodologies, namely on how to take the maximum from individual and team work within the time slot available to accomplish the tasks. This is more noticeable at laboratory classes when a plan of sequential actions needs to be designed, discussed and performed within the group. Although collaborative work and project groups are good learning some students tend to assume a passive attitude while others try harder and focus on the main objectives. However both tend to become unmotivated [1]. To keep or improve motivation, the idea of very difficult piece of work to accomplish or repetitive and useless tasks should be avoided. Some key factors that contribute to student's motivation are: a clear idea on the applicability of the concepts and a focus on "how and why it happens" or "how it works". Another key factor is the applicability of graduation projects that may give to younger students the sense that they are also capable of doing the same.

Following an earlier work on engineering education issues [2], the authors proposed and supervised two separate graduation projects that can help students at laboratory classes, both requiring hardware/software skills. One project aimed the automation of a didactic KIT MTS 7.6.5 for Antenna measurements manufactured by Leybold-Didatic. It consisted on designing a mobile platform actuated by stepper motors to mount the receiving antenna, able of translational and rotational movements, an interface card with data acquisition

features and application of software supported in Windows® to control all the system. In that way the system is capable of collecting data, represent the antenna radiation pattern and export data in Microsoft Excel format for further process. The aim of the other project was to help students on studying computer architecture and organization and instrumentation electronics, namely the functioning of internal buses, peripherals, I/O ports and ADC and DAC devices. Also how software interconnects with hardware. For didactic purposes the E-ISA bus was chosen and some obsolete PC with Windows® 98 were used. Users can define two independent channels with standard signals; specify voltage, frequency, duty cycle. The correspondent results are generated in a prototype card addressable and that fits into the E-ISA bus.

A. Collaborative Work Experience And Results

The PC based Signal Generation system can be used as signal source and connected to the Automated Antenna KIT system as external signal source and form a fully automated test station based on a single computer. The final system allows a significant cut on time spent with manipulation and repetitive tasks and avoids errors on measures of voltage signals. The results when carrying both graduation projects were very good as there was a great commitment from the term year students on finding solutions and testing different approaches. The experience was also positive on strengthening team work between the two groups due to the practical interconnections. Another point that deserves to be mentioned is the enthusiasm and expectations from freshmen students, especially on how it could facilitate their work on measuring antennas; also the perception of digital systems, memory spaces, I/O addressing and instrumentation devices, from the practical point of view.

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FPGA/Embedded system Training Kit Targeted to graduate Courses towards Industry level short training

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The wide application of embedded systems becomes a trend in the post-PC era. In the College of Engineering, Universiti Tenaga Nasional, embedded system education is one of the characteristic subjects, so “practical training” is the brand new characters as the most important process in the embedded system education towards Industry training. Practical training is an on-campus process to gain the practical experiences which are suitable for the real IT/Design companies, especially for the students without work experiences. Practical training using single Kits on embedded system has spread to most Electrical & Electronic Engineering undergraduate & MEE students. The course has been updated towards Industry employees training to meet their design aspects. Embedded systems course have been deployed in numerous fields which have different requirements of embedded systems architecture. In this paper, a project-based learning strategy using single training kit is proposed as a pedagogical tool for embedded system education. The proposed project-based learning can motivate students to integrate and formulate the multi-disciplinary knowledge previous learned into a real-world embedded system project development. The course development focused on lecture–lab integration and laboratory learning. Course and lab activities were designed using a learning model that captures lower-order and higher-order cognition levels of Bloom’s taxonomy.

Many universities offer introductory courses that focus on microcontroller-based systems and embedded programming using different training kits. Advanced courses often do not have a common focus and are not available until the graduate level, leaving a gap in training undergraduates. The courses are integrated through a coordinated set of learning outcomes and the use of related tools and technologies. In addition, the courses are designed with special attention to integrating the lecture and laboratory experiences, making explicit the relationships between lecture topics and laboratory exercises.

Design Samples for the courses using single Kits:

Embedded “C” Programming	<ul style="list-style-type: none"> a. Pointers (Accessing content of memory locations) b. Serial communication + Byte Transfer + Array-type Variable c. Ethernet: Send/Receive Data Byte
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	<ul style="list-style-type: none"> to an IP node d. Interrupt & handlers e. Image Processing (Use of sorting in a Median Filter)
HDL	<ul style="list-style-type: none"> a. Combinational logic (examples: decoder, mux, DFF) b. Synchronous state machine / State machine c. Embedded Processor & Hierarchical Buses d. Custom IP cores & Bus Interfaces e. Image Processing (median, binomial, negative)
HW/SW Co-design	<ul style="list-style-type: none"> a. Architecture b. Processor Buses & Busses Protocols c. IP cores: <ul style="list-style-type: none"> 1. Timers 2. Serial Communication 3. Configurable Parallel Port 4. Interrupt Controllers d. Interrupt Handlers/ Processor context switch
Digital Logic	<ul style="list-style-type: none"> a. Combinational logic (examples: decoder, mux, DFF) b. Synchronous logic; state machines c. Applications
<u>System Software</u>	<ul style="list-style-type: none"> a. Script Linker file, make file b. System timer c. Multitasking & multithreading d. Device Drivers (Device Polling/ interrupt driven)

A single kit can provide training for various domains such as programming language, digital system (hardware descriptive language) and basic image processing. It comes with an option for future updates. Since the training modules are designed with the objectives to reduce learning efforts and industry relevant, it will benefit many students.

An integrated kit for both hardware and software lesson modules that can improve learning outcomes especially on programming language, microprocessor, digital system, image processing, and system software. This product can be reconfigured infinite number of times for lesson updates and level of difficulty adjustments.

Educational Software Interface for Power Electronic Applications

Abstract—The design of friendly user tools for power electronics applications is a hot topic among the researchers all over the world. In fact, the digital signal processors programming is a hard task which requires a deep knowledge of the specific hardware platform where the user program is implemented. In this paper, a user interface for programming DSPs to control a power electronic converter is presented. The proposed program, called *jscomm*, is currently used as a useful tool to understand how the DSP is programmed, to control a power converter safely and to monitor all the interesting variables of the power converter operation.

I. THE PROPOSED USER INTERFACE (*jscomm*).

The simulation of power systems is a fundamental topic of electrical and electronic engineers all over the world [1], [2]. However, only by simulations, the students and/or researchers do not work with real prototypes and they do not notice the actual hardware/software problems related with real applications of power converters.

In this paper, a friendly user interface for DSP programming and control of power electronic converters is presented. The software, called *jscomm* has been developed in the Power Electronics Research Group at the University of Seville. The *jscomm* software is currently being used for post-graduate students in order to develop control techniques for power electronic converters as a part of the required knowledge to get the PhD degree. It is being applied to medium-high power systems but it can be also used for low power applications.

A. The oscilloscope tool

The *jscomm* also provides an oscilloscope plotting any variable (control or measured) of the power system (the number of channels is configurable). In this way, the operation of the power converter can be monitored online and the implemented control technique can be tested safely. A snapshot of the oscilloscope present in the *jscomm* is represented in Fig. 1a.

B. The controller adjustment tool

The *jscomm* users can design different control techniques to be implemented in the power converter. The *jscomm* permits to change the values of the controller constants during the operation of the converter making easier the controller constants tuning process. This fact can show the impact of any term of the controller on the performance of the control variables. For instance, considering a classical controller where an external voltage control loop and an internal current control loop are used, the influence of the proportional, integral and derivative PID controllers on the dc voltage or the phase

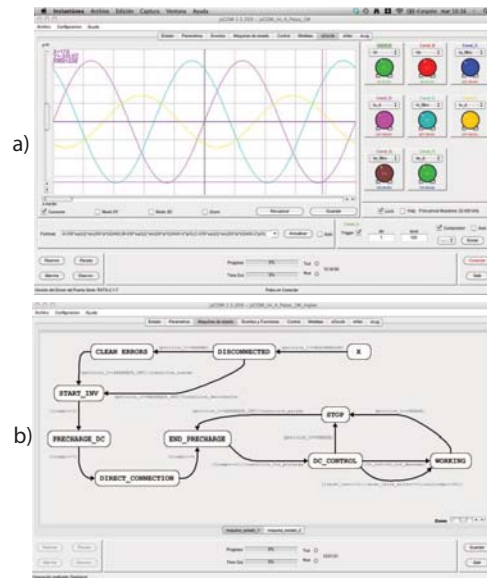


Fig. 1. a) Eight channels oscilloscope where control or measured variables can be plotted online b) States machine screen where the possible states and the transitions are defined.

currents can be measured. This can help to novel power control researchers to understand the operation of the power converter and the controllers design.

C. The states diagram tool

One of the most interesting characteristics of the *jscomm* is that it includes a tool for developing a states machine to control the power system. The states machine is plotted using classical diagrams where the states and the conditions to carry out the transitions are defined. This diagram directly generates the corresponding C code to be implemented in the DSP. In this way, the generation of the states machine, needed in most of the power system applications, is simplified. An example of the generation of the states machine for a conventional three-phase power converter rectifier is represented in Fig. 1b.

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Session: 06B Area 3: Specific Engineering Disciplines - Practical projects in Engineering

Practice and Research in Engineering Education: Activities of the CESEI Technical Committee

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A Practical Electronic Instrumentation Course for Engineering Students

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Teaching Microprocessors Design Using FPGAs

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Practice and Research in Engineering Education

Activities of the CESEI Technical Committee

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Abstract—This paper shows the activities of the Technical Committee of the CESEI (Spanish Chapter of the IEEE Education Society). The CESEI is focused on the development of the education in engineering, mainly Electric and Computer Engineering, and the Technical Committee is devoted to contribute to its awareness and dissemination. As in other interdisciplinary fields, the engineering education field involves several sources of information and different stakeholders, each one with its own focus and purpose. As a result, sometimes it may be complex for practitioners and researchers to identify the more appropriate entities for their interests. The CESEI Technical Committee tries to solve this difficulty by providing updated information about the main publications (journals), events (conferences), organizations and other elements of interest.

Keywords: e-learning publications, e-learning research

SUMMARY

Nowadays there exists a large scientific community supporting the engineering education discipline. At engineering universities and schools it is very common to find researchers and research groups working on engineering education problems. Many engineering companies also have created groups to work on these topics in the context of life-long learning or career development programs. At a higher level, persons, groups and companies are joined into national and international associations whose main purpose is to work towards the development and empowering of this discipline. These organizations sponsor a large number of events and publish journals and books focused exclusively on engineering education problems. Some of these events and journals have been assessed as very relevant by main research indexes.

This interest on engineering education is also present in one of the most important engineering associations: the IEEE. The IEEE is the world's leading professional association for the advancement of technology. The IEEE name was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organization's scope of interest has expanded into so many related fields, that it is simply referred to by the letters I-E-E-E (pronounced Eye-triple-E). IEEE includes many unique technical organizations, active in the

areas or publications, conferences and building technical communities. Among these organizations, the Education Society (EdSoc) was created with the main aim of “*shall be scientific, literary, and educational in character. The Society shall strive for the advancement of the theory and practice of electrical and computer engineering and of the allied arts and sciences, and the maintenance of a high professional standing among its members and affiliates, all in consonance with the Constitution and Bylaws of the IEEE and with special attention to such aims within the field of interest of the Society*”. His fields of interest are: “*Educational Methods, Educational Technology, Instructional Materials, History of Science and Technology, and Educational and Professional Development Programs within Electrical Engineering, Computer Engineering, and allied disciplines*”.

In 2004, it was created the Spanish Chapter of the Education Society of the IEEE (from now on CESEI). The CESEI has the same fields of interest and aims that the IEEE EdSoc has. Nevertheless, the CESEI is focused in Spain and in the Spanish tongue area [1]. Inside the CESEI several Technical Committees were created CESEI [2], one of them devoted to the dissemination and awareness of the engineering education field.

The final goal of the CESEI is to promote the development of this discipline supporting practitioners and researchers. To contribute to this goal the Technical Committee provides updated information about relevant conferences, journals and organizations. We consider this information very useful for professionals and researchers, because it is offered a clear picture of the main actors involved and the key sources of information. This paper is produced as a contribution to this effort, including an updated and complete compilation of engineering education associations, conferences and journals at world and Spanish levels.

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A practical electronic instrumentation course for engineering students

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ABSTRACT

A course on Electronic Instrumentation has recently been developed at the Universidad Autonoma de Madrid (Spain), which specifically emphasizes practical aspects. The objective of the course is to link theoretical principles with practical issues of electronic instrumentation through the development of a final project. First, students take practical work in several different scenarios, which are the basis for the design of an engineering project aimed to solve an electronic instrumentation problem which is set by the students. Students are exposed to a set of multidisciplinary aspects, both theoretical and practical, providing them with the ability of integrating blocks in which they have practically worked into a full instrumentation project. The course provides not only enhanced academic training but also increased student motivation, as students are encouraged to propose their own projects.

Key-words: electronic instrumentation, practical approach, correlation theory-practice, student evaluation.

Teaching Microprocessors

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Abstract— Microprocessors is a typical subject within the Computer Architecture field of scope. It is quite common to use simulators in practical sessions, due to the complexity of its contents. In this paper a new methodology based on practical sessions with real devices and chips is proposed. Simple designs of microprocessors are exposed to the students at the beginning, rising the complexity gradually toward a final design with a multiprocessor integrated in a single FPGA chip. Finally, assessment results are shown.

Keywords: Learning Experiences; Laboratory Experiences

I. EXTENDED ABSTRACT

Traditional laboratory practical sessions to teach microprocessors are based on simulators, in this paper an experience implementing real microprocessors is shown. The main purpose is to encourage the student interest and to improve the assessment. This proposal is useful for many subjects with in several engineering degrees. This activity was carried out at the University of Córdoba.

In most cases, computer architecture has been taught with software simulators. These simulators are useful to show internal values in registers, memory accesses, cache fails, etc. However, the structure of the microprocessor is not visible, and students are not aware learning a real processor.

A methodology for easy design and real implementation is proposed to provide students with a user-friendly tool. Simple designs of microprocessors are exposed to the students at the beginning, rising the complexity gradually toward a final design with two processors integrated in an FPGA; each of which has a independent memory system, and are intercommunicated with a unidirectional serial channel. Furthermore, an introduction to the architecture of a T1 SUN OpenSparc system with 8 processors, 4 thread/processor plus one MicroBlaze is introduced at the end of the semester while students are working on their projects.

The Xilinx Platform Studio (XPS) is used to design MicroBlaze processors. XPS is a graphical IDE for developing and debugging hardware and software. XPS simplifies the procedure to the users, allowing them to select, interconnect, and configure components of the final system. Performing with this activity, the student learns to add processors and peripherals, to connect them through buses, to determine the processor memory extension and location, to define and connect internal and external ports, and to customize the

configuration parameters of the components. Once the hardware platform is performed, the students learn many concepts about the software layer, such as: assigning drivers to peripherals, including libraries, selecting the operative system (OS), defining processor and drivers parameters, assigning interrupt drivers, establishing OS and libraries parameters.

The practical content of the subject is composed of 8 projects. In the first session, students make a basic system which will be used in following sessions as the base core system. Second and third sessions are used to introduce the input/output flow and the communication with external peripheral through the On-chip Peripheral Bus, for general purpose. SRAM external memory is added to the system at fourth session. Next session is dedicated to the External Memory Controller and how to split the bus. MicroBlaze interruptions are added in the sixth session, and external interruptions using the interrupt controller are included in the seventh session. Finally, students build a biprocessor, using the Fast Simple Link channel at session eight.

II. CONCLUSIONS

XPS can be used as an excellent tool for the students to design and build complex architectures avoiding implementation details. Otherwise, they would spend a lot of time until they master concepts and techniques to develop those systems. Students understand the functionality and the structure of the different components, in order to interconnect all of them to build either a monoprocessor or a biprocessor. A notable improvement of the qualifications compared to the average of the previous five years was obtained. Students are more motivated using real devices than using just simulators.

Furthermore, the configuration of each of the component parameters contributes to a better understanding of the developed architecture. And they are able to test how different values for those parameters influence the performance of the whole system. Finally, a tutorial on how to implement several processors systems on a single FPGA chip has been provided.

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Development of a Small Radio Telescope at the Technical University of Cartagena

A duty with our students and society

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Abstract— An initiative carried out at the Technical University of Cartagena (UPCT, Spain) to encourage students and promote the interest for Scientific and Engineering Culture between society is presented in this contribution. For this purpose, a medium-term (4 years) project based on the design, fabrication, testing and set-up of a small Radio Telescope system has been carried out. The main novelty is that this project is entirely being done by students of last courses of our Telecommunication Engineering Faculty, under the supervision of four lecturers.

Keywords- Electrical engineering education; Electromagnetic engineering education; Systems engineering education.

SUMMARY

As we are immersed in the “Bologna process” to reach the EEES (Europe an Space for Higher Education) [1], academic and government regulators request for innovate experiences to improve the learning process, highlighting the necessity of development of more practical, less theoretical, teamwork, interdisciplinary competencies. Very worrying is the reality detected in the last decade that shows that young people around Europe are losing their interest in Science and Engineering culture. Being aware of these facts and feeling responsible as part of a public University, some lecturers of the Telecommunication Engineering Faculty at the Technical University of Cartagena (UPCT) decided to undertake the experience of involving our last course students in the development of a small Radio Telescope.

These lecturers coordinate some Radio communications syllabus like Electromagnetism, Antenna Engineering and Microwave Engineering [2, 3]. We thought that Radio Astronomy [4] is an interesting application of Microwave Engineering that might motivate students to put effort in these courses. Moreover we thought if we involved the students in the setting-up, working, maintenance and enhancement of a Small Radio Telescope could be a good idea to have a permanent practical laboratory where they could feel free to improve their knowledge and skills related with microwave technologies. Besides, this Radio Telescope can serve as tool to attract future students to our Faculty, and also very useful to disseminate Radio Astronomy between non-specialized individuals and society in general. The main novelty of this activity is that the entire Radio Telescope system (see scheme in Fig.1) is being entirely developed, manufactured, tested and set-up by the MSC

This work has been partially supported by Regional Séneca Foundation under project 02972/PI/05 during 2006-2008, and partially by Technical University of Cartagena (UPCT) during 2009 and 2010. This project would have not been possible without the excellent response and enthusiasm of our students.

students, using the facilities available in our modest laboratories. To our knowledge, this is the first proposal in Spain to promote Radio Astronomy with these particular characteristics, if compared with other public proposals [5-7].

In this presentation, we will emphasize the objectives of this project and we will show the methodology used to improve the learning process of the aforementioned courses. Also, the response of the students and the results obtained (see Fig. 2) will be addressed in detail, together with the main future lines.

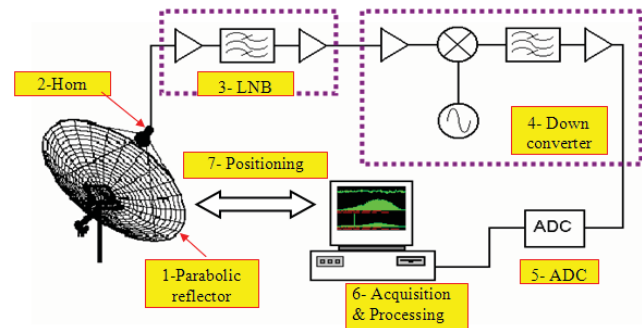


Figure 1. Scheme of the Radio Telescope subsystems



Figure 2. Students and lecturers at work mounting the antenna subsystem

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Session: 06C Area 1: Collaborative and Social Technologies - Experiences

Applying a methodology for collaborative assesment in learning groups

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Web 2.0 contents for connecting learners in online Learning Network

Koper, Rob;Nadeem, Danish;Stoyanov, Slavi

CELSTEC - Open University of Netherlands (Netherlands, The)

**Innovative Learning and Teaching Methodology in Electronic Technology Area.
A Case Study in Computer Science University Degrees**

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An Experience in Cooperative Learning Developing a Real Aerospaceal Project

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Applying a Methodology for Collaborative Assessment in Learning Groups

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Abstract—Collaborative evaluation is still a less explored subject within the collaboration field. This paper proposes a methodology to collaborative evaluation based on the 3C collaboration model, which can be applied both in learning or working groups. This paper also presents two case studies run on graduate courses of the Computer Science Department of Catholic University of Rio de Janeiro for collaborative evaluation of the students work. The case studies suggest that the methodology is appropriate for this type of assessment. In addition, students participating in the experiment rated the experience as positive, confirming the premise that students value and miss the collaborative evaluation.

Keywords- Collaboration, Groupware, Collaborative Evaluation, Assessment

SUMMARY

Collaboration is a process by which individuals negotiate and share relevant insights to solve a problem. It is a coordinated and synchronous activity, result of a continuous attempt to construct and maintain a shared understanding of a problem [1]. In collaborative learning, the student is responsible for his/her own learning, and collaborates with the other group members' learning, constructing knowledge through reflection on group discussion [2]. The active information exchange instigates interest and critical thinking, allowing learners to reach better results than by studying alone. In collaborative learning, the teacher shifts his/her role from authority to supervisor.

Due to the collaboration between participants, the traditional assessment methods-- in which the teacher prepares a written test and the student must answer the questions correctly-- are insufficient to measure the results of collaborative learning. Much like the learning process, the assessment should itself be collaborative, thus allowing the evaluated student and their colleagues to contribute to the

assessment process, which is no longer the sole responsibility of the teacher. When students share the responsibility of evaluation, the comprehension and the utility of evaluation increase. To the evaluated ones, having several assessments of their work increases confidence on the results of the evaluation. Additionally, the evaluators better understand the process and the objectives of the assessment, thus increasing their critical sense and ability to improve on their own work. Despite the evidence of the benefits of collaborative evaluation, the literature still suffers from the lack of a methodology for conducting such assessment. To fill this gap, this paper proposes a methodology based on the 3C Collaboration Model.

The methodology for collaborative evaluation proposed in this paper presents the necessary steps for the preparation, implementation and dissemination of evaluation results. It is important to emphasize that its use is not restricted only to the educational field. It can also be applied, for example, to evaluate scientific papers for publication at conferences or in the evaluation of corporate projects by coordinators, clients or stakeholders. To validate the application of the methodology proposed in this work in collaborative evaluation of academic work, 2 case studies were performed in graduate classes of the Pontifical Catholic University of Rio de Janeiro (PUC-Rio). After completion of two case studies, it was found that the collaborative assessment methodology was well accepted in both groups.

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Web 2.0 contents for connecting learners in online Learning Network

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Abstract—This paper proposes a conceptual model for designing a people-finding system in a learning environment. The system is intended to help learner in getting recommendation about suitable people who are interested on a learning goal or share common interests with the learner.

Keywords—*recommendation systems; web 2.0; social matching; learning technology; social support system; people-finding systems; learning network; informal learning*

INTRODUCTION

A Learning Network is an online network of people which is intended to support life-long learning [2]. Learners can decide about their learning plans to learn at their own pace irrespective of place and time. However, such learners remain hidden from others (learner's isolation) in the Learning Network, which makes their learning detrimental and less effective. In such an online Learning Network environment getting to know others helps. Specially, when a problem arises or a question is raised in learners mind, a need to find out who are "available", "sufficiently qualified" and "have interests" to provide help or support to learners is a common challenge. Bringing learners together would benefit them in sharing each others expertise and learn effectively by collaboration overcoming learner's isolation. This is actually the basic expectations from any people-finding systems. However, finding suitable people is not a trivial task. The system needs to first "know-about" people's interests and competences, then rank them according to their levels of expertise and finally recommend them to the learners.

We also discuss in the paper some initial results of Concept Mapping methods [1] used for needs analysis for building such a people-finding system in a Learning Network. We claim with the best of our knowledge that this is the first time such a method is used for needs analysis of people-finding system in Learning Networks using a Concept System.

We tackle the problem of finding people in learning networks by developing a Social Support System (SoSuSy). SoSuSy is an artifact that mediates the interaction of the people in capturing and distributing the expertise within a Learning Network. It is a software application which runs in a web

browser to search for people who are suitable match. It is meant to promote informal learning and social interactions in a Learning Network.

The following example scenario will summarize the requirement for such a system.

Scenario: Imagine a Piano learning scenario in which SoSuSy can be used:

"Paul is passionate about mastering his skills in playing a piano. He knows the rules for building major and minor piano scales from any note on the piano keyboard and he learned how to combine these scales to form major and minor chords. Furthermore, he wants to improvise. He is interested in playing Arpeggios, a technique in which the notes of chord are played independently rather than together. Paul is a lone learner and joins a learning network, which has a learning community for sharing expertise and experiences on playing piano. He starts searching for the people associated with Arpeggios in the network. The system looks for others who have interests, knowledge and skills in playing Arpeggios and tells Paul about them. It might happen that Paul already knows one of the recommended people through his social network, but never knew s/he could also play Arpeggios as well. The system makes easy for him to contact that person. He is then happy playing Arpeggios while learning and sharing things together".

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Innovative Learning and Teaching Methodology in Electronic Technology Area

A Case Study in Computer Science University Degrees

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Abstract—This paper describes an experience that has been carried out by several professors in different subjects. Our experience is framed within the First Plan in Teaching of the University of Seville (Spain). All involved subjects belong to the electronic technology area and from three different Computer Science university degrees. We propose to use, in a combined way, some learning techniques: cooperative learning, role-playing technique and jigsaw technique; all of them as complement to traditional learning. In the whole project we have considered a base methodology but in each subject a variant of it has been accomplished. We have used several evaluation techniques, such as reciprocal evaluation, electronic portfolio (by Blackboard system) and check lists. Applying our methodology has helped us to detect learning problems earlier and before the term ends. Also, in tune with the framework of the European Higher Education Area (EHEA), our methodology gives a boost to develop transversal competences so important as work (or study) management, empathy and understanding of other members in the workgroup, conflict resolution, capacity to make decisions as well as coordinate and communicate with other members in a workgroup and also with the professor.

Keywords—component; Innovative education in Engineering, learning techniques, evaluation techniques, cooperative learning, role-playing, jigsaw, reciprocal evaluation, electronic portfolio.

An Experience in Cooperative Learning Developing a Real Aerospacial Project

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Abstract— A lot of training time is devoted to help teachers arrange appropriate interactions between students and materials, and to how teachers should interact with students. However, how students should interact with each other is relatively ignored. It is a good idea that students learn within a supportive community in order to feel safe enough to take risks. Cooperative learning is a successful teaching strategy in which small teams, composed by students with different skills, use a variety of learning activities to improve their understanding of a subject [1]. Each member of a team is responsible not only for learning which is taught but also for helping his or her teammates learn, thus creating an atmosphere of achievement. In this paper an experience in cooperative learning, with a group of students with different skills and ages, developing the harness subsystem of the first lunar spacecraft built and operated by students across European Space Agency (ESA) Member States and ESA Cooperating States is described.

Key words: Cooperative Learning, ESMO, space project European Space Agency (ESA).

SUMMARY

The European Student Moon Orbiter (ESMO) is planned to be the first European student mission to fly to the Moon [2]. ESMO represents a unique and inspirational opportunity for university students. It provides them with valuable and challenging hands-on space project experience in order to fully prepare a well qualified workforce for future ESA missions, particularly those planned by the exploration and science programmes in the next decades. In addition, ESMO has a powerful education outreach aspect and a strong attraction for younger students studying in universities across Europe.

Our teaching group (Power Supply Systems group) is made up of eight researchers, four of whom are PhD Electrical Engineers, and the rest are PhD. students. To be part of the ESMO project developing the harness subsystem of the spacecraft, the group considered to form a team with engineering students and to implement some cooperative learning (CL) strategies. This kind of learning is still uncommon in technical areas of knowledge, but it is considered a key element for improving the capabilities of the students. Although no academic reward was offered, about thirty students of our university from different degrees and with different skills were interested and so the team could be composed. All the members of the team are distributed in a

pyramidal structure, and obviously different classes of members have different responsibilities and tasks into the team.

A. ESMO groups and tools for cooperative working

To facilitate the interaction between the teams developing the different subsystems of the ESMO, the ESA encourages the use of some interactive tools. The most interesting tools are: a Google group, a weekly chat, a biweekly work report, an FTP site for each subsystem, on-line interactive software and four workshops per year at European Space Research and Technology Centre (ESTEC). Thanks to all these tools the members of each subsystem (about 25) have a global view of the evolution of the project. The interaction between students from different countries, cultures, universities, and degrees also help them to develop communication and social skills.

B. Cooperative tools and work in the harness team

The wide range of students is a very important advantage to develop an interdisciplinary topic as the harness of a satellite is. Nevertheless, it is difficult to coordinate so many students, and several cooperative tools have been used to make easier the interaction between all of them, for example biweekly meetings, a Google group, an electronic calendar, a webpage (<http://pels.edv.uniovi.es/ESMO>), etc.

RESULTS AND CONCLUSIONS. METTING OF GOALS

Using the mentioned CL strategies, the needed jobs for the harness subsystem in the ESMO project has been properly performed. CL techniques have been successfully developed. Two Master thesis projects will be presented in the following months about this topic. Students have expanded their knowledge about global and interdisciplinary projects in general and the ESMO project in particular. They have developed transversal competencies, such as the interaction among classmates and between student and teacher, the search of information, the face-to-face and online presentation of their work or the ability to prepare technical documents.

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**Session: 06D ICOPER Special Session: Assessing Assessment Formats -
ICOPER Network**

Assessing Assessment Formats: The Current Picture

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Aligning Assessment with Learning Outcomes in Outcome-based Education

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Current Issues With Assessment Formats and Interoperability

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**Interoperable Content for Performance in a Competency-driven Society: Results
from the iCoper project**

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Assessing Assessment Formats: The Current Picture

Special Session: Assessing Assessment Formats

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Abstract— Student assessment plays a fundamental part in every e-learning process, where it can serve to check whether the learner has achieved the intended learning outcomes (summative assessment), but also as a means to aid in the learning itself (formative assessment). Nevertheless, there exist no formal standards to cover this type of content, just some specifications, such as IMS QTI. In this article, we present a study of formats for assessment and their usage in Europe. We also present a reference metamodel for assessment that covers the needs of all stakeholders in relation to this topic.

Keywords—component; assessment formats, IMS QTI, reference metamodel, ICOPER.

SUMMARY

ICOPER [1] is a Best Practice Network that started in September 2008, funded by eContentPlus programme of the European Commission. As part of the ICOPER objectives, a reference model (ICOPER Reference Model) will be provided and some mechanisms to ensure involvement, cooperation and adoption of standards in the European educational framework. To accomplish this goal, the project will systematically analyse the specifications and standards available and in use, to draw conclusions on their validity.

In the context of the ICOPER project, an effort is under way to analyse assessment standards and specifications. This work has been carried out by the work package “Assessment and evaluation testbed”, led by Carlos III University of Madrid. The analysis has focused on IMS Question and Test Interoperability (QTI) [2] because it is considered as *de facto* standard. Besides, this work package has other responsibilities like proposing a set of best practices in the scope of learning assessment, detecting and solving QTI interoperability problems by helping to complete the available tools to guarantee a robust exchange of assessment material [3].

This paper presents the results of the analysis of assessment formats and specifications, from the technical point of view, and their actual usage in Europe. As a result of this analysis, a reference metamodel for assessment content is proposed as a best practice in the assessment domain.

In this paper, a study of the most relevant assessment formats and specifications in present day e-learning systems is presented. A qualitative comparison has been performed among the studied assessment formats, following a list of defined key features and questions types. As a result of this analysis, a series of deficiencies have been detected in the

studied formats, like the range of supported learning outcomes (limited to knowledge) and the lack of content interoperability. A study of specifications usage has been also presented, concluding that IMS QTI is not used as frequently as expected due to the detected problems [3].

Besides, a study of the concepts of learning assessment has been performed and, as a result of it, a concept map of this domain has been developed. This tool will allow us to know exactly the concepts used in learning assessment and the relationships between them.

Finally a reference metamodel for assessment content has been proposed, which solves the problems found in the specifications study. This metamodel is based on the comparison of assessment formats and the concept map developed previously. It should be also mentioned that the metamodel was defined having in mind assessment content interoperability.

As future work, it is planned the refining of the reference metamodel for assessment content in order to cover all necessary aspects in assessment domain. On the other hand, a data model is also planned to be created, based on the concept map and the reference metamodel, which will allow to carry out an actual implementation of this proposal.

A proof of concept will be executed in the Open ICOPER Content Space (OICS), a federated repository of assessment content, consisting on integrating and managing assessment material. This implementation will be used as validation of the reference model presented in this article.

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Aligning Assessment with Learning Outcomes in Outcome-based Education

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Abstract— In outcome based learning, learning outcomes (knowledge, skills and competences) to be achieved by learners are in the focal point of the learning process. All educational activities and resources need to be related to the intended learning outcomes of a learning module or course, in order to assist the learners in successfully achieving the intended learning outcomes at the end of the learning experience. Outcome based assessment means that the assessment process must be aligned with the learning outcomes. This means that it should support the learners in their progress (formative assessment) and validate the achievement of the intended learning outcomes at the end of the process (summative assessment). It also means that the assessment process should be adapted depending on the kind of outcomes that it is aimed to appraise. This paper presents an insight into the current state of outcome based learning within Europe and proposes a unified conceptual model for outcome based assessment, shaping a theoretical framework for the integration of learning outcomes, assessment and units of learning as key concepts. An application scenario is finally described to illustrate the application of the model.

Keywords- learning assessment, learning outcome, unit of learning.

SUMMARY

The European Union is confronted with the challenge to make Europe more responsive to the labour market's requirements. In other words, European graduates should be equipped with the appropriate knowledge, skills and competences required by workplace to meet the challenges of globally increasing competition. In response to this challenge, the Bologna Declaration [1] encourages a paradigm shift promoting the idea of putting the learner into the centre of the learning process and of concentrating on the intended learning outcomes of this process instead of what has been provided as input by teachers and instructors.

Learning outcome means statements of what a learner knows, understands and is able to do on completion of a learning process. It covers knowledge, skills and competences that a learner should attain when successfully having finished a unit of learning. Such unit of learning is defined as a contextualized, complete, self-contained unit of education or

training that consists of a teaching method and associated content. Learning outcomes and assessment are connected in two ways. At design time, learning assessments are designed to evaluate the attainment of *intended* learning outcomes. At runtime, learning assessments provide information about *actual* learning outcomes achieved by a learner. Figure 1 shows the simplified concept map relating the three aforementioned concepts.

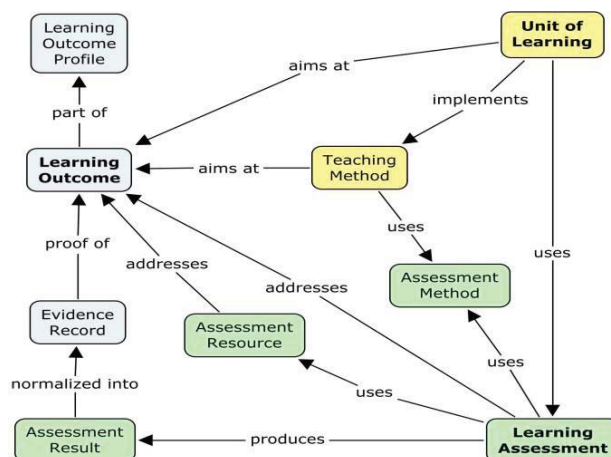


Figure 1 Concept map for learning outcomes-based assessment.

In this paper, the ICOPER [2] project approach for developing outcome-based assessment and units of learning is presented. The alignment of assessment items to learning outcomes to be achieved by learners is discussed in a novel theoretical framework and reference model for assessment in outcome-based educational environments.

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Current Issues With Assessment Formats and Interoperability

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Abstract—Assessment has been one of the areas in computer supported learning where technology has been quickly deployed. Support for computer based assessment is found not only in all Learning Management Systems, but also as stand-alone tools. This large number of tools has led to the appearance of a large number of formats to store, retrieve and exchange assessment material. Although institutions such as the IMS Global Consortium have proposed specifications (e.g. IMS QTI) aimed to facilitate the exchange of this material, in the actual landscape, there are still too many formats that significantly hinder the reuse of this material. In this paper an analysis of the implementation of these formats is described.

Keywords—assessment format, interoperability, IMS QTI

SUMMARY

In today's e-learning, the advance and support offered by technology is very uneven. Some aspects of a learning experience are fully supported by technology (for example assessment), whereas in others, technology is barely beginning to appear (for example, integration of generic services in a learning environment). Assessment has been one of the aspects where technology has had a very strong presence from the early times. Some computer-based assessment tools even predate the appearance of some learning management systems (henceforth simply LMS).

The issue of storing assessment material is intrinsic to computer supported assessment. Once a scenario where any form of computer supported assessment is performed the problem of how the material is stored and retrieved already appears. There are two dimensions in which this problem can be solved. The first one is considering only a single tool or product. In other words, given a tool for computer-based assessment (or an equivalent functionality present in a LMS), how can the assessment material be stored and retrieved by any instance of this tool.

But this issue, combined with the wide variety of solutions for computer-based assessment that are currently available, poses a second problem, that of interoperability. Suppose a

scenario where Institution A has a rich set of assessment material that created using Tool A (or its equivalent service in the corresponding LMS). Analogously, Institution B has also a rich set of assessment material, but it was created with Tool B. Both tools are totally unrelated and therefore, store the assessment material in completely different formats. So far, none of the tools has acknowledge the other format as one that is supported. These two institutions have identified the potential of sharing this material, but it is not possible with the current formats.

The problem, then is to go beyond formats locally used by specific tools to a format that allows the exchange of assessment material among unrelated tools. The approach followed by international bodies such as the IMS Global Learning Consortium [1] has been to gather a set of experts in the field, analyze the current scenarios where computer-based assessment was being used and propose a format such that any tool would be using to both export and import assessment material. This format proposed by the consortium is IMS Question and test interoperability [2], henceforth IMS-QTI.

The appearance of this specification changed the landscape of assessment formats. For any tool providing computer-based support, the question of supporting IMS-QTI appeared. But the evolution of this specification over the last nine years shows numerous examples of the effect of several design decisions. Of course, it easy now to evaluate how appropriate a specification is to represent assessments. But computer based assessment has reached a stage which can be considered main stream and therefore there is some value in looking back and see how the once foreseen effects really shaped. In the following sections an analysis of the current landscape with respect to this format is analyzed. First a brief description of the aspects covered by IMS-QTI and the different available versions is given. Then a brief account of the type of support offered by the different tools is described. It follows the description of a case study in a scenario in which true cross-platform interoperability was needed. Finally, some conclusions are proposed to improve the level of interoperability among current computer-supported assessment tools.

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**Session: 07A Area 2: Innovative Competitions and Laboratories - Digital,
Communication and analytic issues**

**Collaborative Subjects for Embedded Systems Learning in the EHEA Frame:
A Practical Approach**

Cancelas, Jose A.;García, Pablo;González, Victor M.
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**Wireless4x4: an integrating learning experience for Telecommunications
students**

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Cooperative assessment in the hands on skills of computer networks subjects

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A Tool to Reveal the Students Work Activity Along an Academic Period

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Collaborative Subjects for Embedded Systems Learning in the EHEA Frame: A Practical Approach

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Abstract—This paper presents a teaching experience related to the learning methodology in embedded systems within the European Higher Education Area (EHEA) frame. A Problem Based Learning (PBL) methodology has been applied for combining two courses of a bachelor degree in computer systems. The objectives are the integration and application of previously acquired and new knowledge to create an application for the supervision and control of a mobile robot. Technologies used during the development of the project include real-time programming using Ada language, digital control theory and communications.

Keywords-component: PBL, real-time systems, digital control, supervision.

SUMMARY

Traditionally, technical courses at engineering degrees are organized following a logical sequence, being the earlier the base for the later. However, almost no effort is put on presenting the students with the idea that the integration of the different knowledge and technologies acquired along the different courses, is a fundamental skill in order to be able to solve complex multidisciplinary problems, like the ones they will have to face at disciplines like systems engineering, computer systems engineering, or embedded systems engineering [1]. After completing an engineering degree, the students end up with a wide collection of weakly related concepts and skills organized as watertight compartments [2]. This paper describes a model to mitigate this main drawback by combining two courses in a collaborative way. These courses are Supervision and Control of Systems (SCS) and Real-time Systems (RTS), which are part of the Computer Systems degree offered at the Bachelor Technical School of Computer Systems Engineering at the University of Oviedo, Spain.

The PBL methodology has traditionally been used in higher education, especially in medical training, and has proof to be a very powerful contextual, collaborative and constructivist learning model [3]. The PBL methodology [4] allows posing a complex problem, which requires integration of knowledge, before learning [5]. Following this methodology, the students are able to discover that in order to solve the problem they first need to acquire new knowledge. However, an eye must be kept on PBL detractor's arguments which suggest that students taking courses based on PBL model show potentially

significant gaps in their cognitive knowledge base and do not demonstrate expert reasoning patterns [6].

A blended learning model was adopted by both courses in order to get the best from PBL and minimize its drawbacks. On one hand, PBL was selected as the learning methodology for the hands-on laboratory classes, so the students were able to develop their constructive, self-directed, and collaborative capabilities. On the other hand, a more classical learning methodology was maintained for the theoretical classes, thus assuring that the students developed their cognitive knowledge base and expert reasoning skills.

Besides, an innovation was introduced to the PBL methodology so multidisciplinary problems solving objective was achieved: both courses shared a common complex assignment by yielding part of their class time for its commissioning. A common assignment was selected as the final evaluation method because implementation of real-time control systems requires, in general, the interaction between different process layers: real-time control of individual systems, real-time coordinated control and supervision. Often, these layers are programmed in different languages and require the use of different tools in order to build the overall system.

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Wireless4x4: an integrating learning experience for Telecommunications students

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Abstract—In this Problem Based Learning (PBL) educational project, groups of students build a complete system that is able to autonomously drive a radio controlled car, involving different technologies such as wireless communications, positioning systems, power management or system integration. The objectives of this project are the development of an active learning methodology; the acquisition of professional skills; and the participation of the students in an interdisciplinary engineering project with real constraints.

Keywords: *integrating learning; problem based learning; professional capabilities training; telecommunication engineering*

INTRODUCTION

The Telecommunications Engineering (TE) degree contains a broad variety of knowledge areas, such as signal theory and communications, computer networks or radio propagation. This makes it hard for the students to integrate all these knowledge, which in turns results essential to tackle real and practical problems. Therefore, we have carried out a Problem Based Learning (PBL) educational project [1], [2], so-called Wireless4x4, in which groups of students have to build a complete system able to autonomously drive a radio controlled car. The vehicle trajectory is controlled by an autonomous algorithm, executed by a control external computer using GPS coordinates obtained from an on board computer. A WiFi network communicates control and on board computers.

The objectives of this educational project are: (1) The acquisition of integrated knowledge and skills on a variety of subjects through an active learning methodology; (2) The acquisition of professional skills like teamwork capabilities, oral and written communication, and task scheduling; (3) The participation in an interdisciplinary engineering project with time and budgetary constraints.

METHODOLOGY

Second year TE students are the participants of this project, having basic knowledge on circuit design, digital communications and object-oriented programming. The Wireless4x4 is structured as a PBL project with four phases. Firstly, in the motivation phase the problem to be solved and the general structure of the project are presented in a cooperative session in which the basic solution is investigated

with a brainstorming technique. The students' knowledge gaps are analyzed in order to establish an initial training strategy, also providing an initial evaluation. Secondly, in the basic research and resolution phase, the students are organized in four groups, and an independent task is assigned to each group, which must study and solve a problem in different knowledge areas: (1) On board power system; (2) Wireless network for the on board and control systems; (3) Location and driving algorithm, and (4) Hardware and software integration. The partial solutions are integrated to build the basic prototype. After this, an intermediate evaluation is carried out while the groups present their results and share their knowledge. Thirdly, in the advanced research and resolution phase, the students are reorganized in different teams, and propose improvements for the basic solution. Finally, as part of the final evaluation, the teams participate in a competition, in which their prototypes must autonomously cover a previously set up circuit.

EVALUATION AND CONCLUSIONS

A three-fold evaluation was carried out: an evaluation of the technical knowledge and professional skills acquired by the students; a survey of the students' opinion; and a final evaluation made by the participating professors. Results from the first evaluation were highly satisfactory, since most of the participants achieved an appropriate level of knowledge in all the studied areas. Students' survey pointed out that the strongest aspects of the project were its interdisciplinarity, the practical approach, and the general methodology (work in groups with a high degree of freedom), while the weakest points were the high amount of work and the hard initial learning curve. On the other hand, all the educators showed their satisfaction with the students' achievements, and pointed out the high work load. In summary, during these two years, the Wireless4x4 project has showed to be a successful and innovative method for providing the students with an integrated overview of several knowledge areas of the TE degree.

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Cooperative assessment in the hands on skills of computer networks subjects

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Abstract— The cooperative assessment system promotes teamwork, increases the mental practice and develops the social skills that are so necessary in the working life. In this paper we present the experiences and methodologies undertaken to assess the subjects “Local Area Networks” and “Networks Integration” of the Degree in Technical Engineering in Telecommunications of the Higher Polytechnic School of Gandia of the Polytechnic University of Valencia, Spain. This courses attempt to stimulate the students' motivation and teamwork through various activities and to provide the appropriate training to safely resolve situations that may be happen in real life. This article shows the opinions of the students, their feedback and their marks. All these data will be used to improve the teaching methodology for the next year. Finally, the main aim of the courses has been achieved, because the survey results, the opinions of these students, and their marks have been very satisfactory.

Keywords- Cooperative assessment, Collaborative groups, Work in groups, Problem-Based Learning.

SUMMARY

The assessment of the student's training, as an individual or as a part of a group, is a process that has to be continuously done along the course. Moreover, the end of the teaching period carries a closure which involves some results review. It is very difficult to know how we should evaluate the students when a complete assessment of the skills of them is wanted. One of the main problems in the cooperative methodology assessment is to evaluate the individual marks of the student's knowledge about the content of the subject. To evaluate the cooperative competences learned during their cooperative tasks is also difficult. The lecturers must also control shirk students and the students' cooperation [1] [2].

Since several years ago, several lecturers of the Higher Polytechnic School of Gandia are working with the introduction of different types of training methodologies. These skills are applied to different subjects of the Degree in Technical Engineering in Telecommunications. Collaborative Learning is the method used in the subjects “Local Area Networks” and “Networks Integration”. Both subjects are placed in the last course of the degree, thus it seems to be the best place where the method could be implemented.

In order to evaluate the teaching-learning process, the following methodology of cooperative assessment has been designed. The overall length is eight months divided into two parts. The first four-month period prepares the students to overcome problems in the field of local area networks. In the second four-month period the complexity is higher because the

students work with wide area networks and they should be able to integrate these networks. The main goal of the assessment system is to motivate student's continuous learning, promote the team working and to develop the student's communication and scheduling abilities. The evaluation is mainly divided into two stages in each four-month period.

In one stage the student applies the acquired theoretical knowledge to practice sessions. In order to do so, a guide with the steps to follow for each practice session is developed. Initially, the practice is performed individually, but in a certain stages, it can't be completed unless another student has finished his task, so it is needed collaboration. In order to pass to the next stage, the student has to complete the 80% of the practical activities at least. In the assessment stage, a final practice assessment, where a real situation is simulated, using students' collaboration is made. It is presented to the students 24 hours before the exam date. It lets the students to prepare it and to plan an appropriate organization to face the problem raised. When the final practice assessment takes place; the lecturer randomly assigns students to several groups. The students must collaborate with their partners in order to perform their task. The tasks will also be assigned randomly. The group mark will depend on the global results obtained by the group for the proposed tasks. The individual mark is obtained according to grade of correctness and the collaboration or the information exchange between the students during the exam. The final mark is obtained from both, the individual and the group mark.

This study shows that the method had a positive acceptance by the students. Compared to other subjects, students have higher final marks and there are more students that pass this subject than other subjects. The training-learning process has a positive feedback for the lecturers. The hands on skills in the laboratory and the collaborative assessment push the students to learn from real situations and problems, and from the experience. The main drawbacks or difficulties observed from the point of view of the teacher have been that the lecturer has to be a high expertise in the topics of the subject.

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A Tool to Reveal the Student's Work Activity Along an Academic Period

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Abstract— This paper presents a web application designed to allow better workload distribution during a semester. The tool was designed to face the new goals that are required for teachers that work within new methods that are fostered by the Bologna Treaty implementation. The tool can help course administrators to improve the effect of some extra-initiatives (talks, workshops, tours, short courses, amongst others), without compromising the performance of students on their work scheduled for the course activities. The paper presents and discusses the motivation and the developed tool.

Keywords—Internet; education; workload; pedagogy; interaction

SUMMARY

Nowadays high education institutions, all over Europe, are getting the first results from the implementation of the Bologna Treaty guidelines. According to [1] this treaty's main goal is "... to create the European higher education area by making academic degree standards and quality assurance standards more comparable and compatible throughout Europe, in particular under the Lisbon Recognition Convention..."

After the treaty implementation, in several Universities, Polytechnics or High Schools, the results begin to emerge and are in some cases reasonable but on the other hand there are some unsatisfactory results. These results depend not only on the institutions where the treaty was implemented but also from the actor's (teachers, students, etc.) point of view. According to [2], one of the consequences of the Bologna treaty is that "Teacher-centered knowledge-based teaching, resulting from memorization, turns into more democratic and balanced model where the student and teacher are closer and where personal contact is more prolonged and with more benefit for both. In this new model the student is responsible at a different level his/her work being more independent, autonomous and

creative." This means that the student's learning process is more based on the work and research they do, in an active way, than on the passive listening to what teachers say. A consequence is that teachers propose several works that must be done by students in the scope of the classes/subjects that they are registered on. This can lead to an excessive workload during certain phases of the semester or academic year.

It isn't our purpose to analyze the Bologna treaty implementation in this article. Our goal is to present an application that was designed to help the supervision of students' workload and to help teachers to have an idea about the amount of work of their students, having also in consideration the other teachers work proposals to those same students. This necessity was detected throughout the students' feedback that complained about the excessive workload required by the teachers during the semester. As consequence of this excessive workload we have notice an increasing class absence of students in the last weeks of the semesters because the deadlines to finish and deliver their works are generally in this period of time. If students have subjects from previous academic years, due to failure in past year(s), this scenario becomes even worst. To try to smooth the student's workload and give a different perspective to the involved teachers, a web application was designed and it is the main contribution of this paper.

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Session: 07B Area 3: Knowledge and Competencies Management - Knowledge

Knowledge Management and organizational learning University-Company - Learn to Learn-

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Approach to Teaching Communications Systems by Collaborative Learning. Student Perceptions in the application of Problem-Based Learning.

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Platform for teaching of location technologies based on Zigbee Wireless Sensor Networks by learning-through-play theory

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Adapting the Telecommunication Engineering curriculum to the EEES: a project based learning tied to several subjects

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Knowledge Management and organizational learning University-Company

Learn to Learn

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Abstract— this paper has information about the elaboration process of a knowledge Portal based on the relation between University and Company. During this process, a study about knowledge management technologies was done to guaranty that the knowledge-life-cycle will be present in the relation between Universities and Companies; it could be implicit or explicit knowledge. One of those technologies used were knowledge management models (we present an alternative knowledge management model focus on University-Company), knowledge maps to identify and locate the knowledge present inside the organization. Theoretically the contribution of Eduardo Bueno [1], gave us a support to set the model based on his proposed model Intellect.

The Project was proposed as a solution to the detected problems because of the lack of communication between University and Company. One of the problems that we found was social problems and others were technological problems, both of them appear as a result of the economical crisis around the world.

Keywords-component; Knowledge Management; Knowledge Management, Knowledge Portal, Organizational learning, TICs, University-Company, knowledge maps, knowledge management model, Web 2.0.

ABOUT THE PROJECT

The Project was propose as a solution to the detected problems because of the lack of communication between University and Company. One of the problems that we found are social problems and others are technological problems, both of them appear as a result of the economical crisis around the world.

The current crisis, produce unemployment talking about the people who had just graduate or the amount of company that become bankrupt because of the lack of innovative process, products and services that allows them to be competitive in the rising marketing. However, inside the university there are innovative developments of products more specific inside research groups. Sadly, most of the times, these products are not use properly and became obsolete.

These products could be implemented inside companies so that they can generate innovative products and services in order to be competitive. So, the purpose of this project is divided into two different goals, they are: set a new knowledge management model (UNEM “Universidad- Empresa”, that identify the knowledge every person in the organizations has and its behavior, it means, how it knowledge is use inside the organization to generate utilities, new process or create new products and services, developing a Knowledge Web Portal supported by a robust standard (J2EE “Java 2 Enterprise Edition”), with implementation of different tools of Web 2.0, among other systems that allows the interaction between the portal users, as well as easy share information, such as, products and services of companies and research groups of Universidad Distrital Francisco José de Caldas. Based on a model that was proposed, the idea is use knowledge management to change the organizations (University-Company) minds and made they learn to learn of themselves.

Also, is important that University and companies understand the importance of communication between every single person in the organization. This Project is a technological alternative to the organizations that really wants learn to use existing resources and learn to generate strategies and opportunities to the members, talking about Universities, students, teachers and researchers [2].

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Approach to Teaching Communications Systems by Collaborative Learning. Student Perceptions in the application of Problem-Based Learning.

Analysis of results

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Abstract—This document reflects the results of the study at the end of the course, which justify how the application of problem-based learning and collaborative learning help the student to take on board in the most appropriate way the study material. A survey conducted showed that students were satisfied with this methodological practice.

Keywords- collaborative learning, learning management system (LMS), problem-based learning (PBL), communication system, education.

I. INTRODUCTION

As teachers we must find a way of looking at the challenges our future engineers face, using new ideas, developing their creativity in such a way as it improves their own knowledge and that they learn the study material at the same time as resolving a problem or proposed project. If, to this way of constructing knowledge using the problem-based learning method (PBL), the achievements of which have been collected in various bibliographical reports, we add collaborative learning to develop the intellectual capacity and the social skills of our students through interaction with their colleagues, as teachers we will have achieved two very worthy objectives: that of giving them knowledge and of providing them with a range of abilities for their future professional development. The use of Moodle, a learning management system (LMS) adapted to the course, contributes to interactivity and the meeting place of our students outside of the classroom, so important for this cooperative learning, the philosophy of which is based on development and analysis.

II. THE MAIN OBJETIVE

This article is based on the analysis of results obtained from the students of the final Industrial Technical engineering course, following the application of the teaching method PBL using “collaborative learning.” Every thing seems to indicate that the PBL method is a better way of imparting education in communications systems, or even technology in general. PBL course students learn social skills through interaction in small

groups, how to identify and define a problem, and how to look for and filter out relevant information. Problem-based learning promotes engagement in meaningful learning and cooperation among students. In the same way, collaborative learning changes the structure of learning in the classroom, permits interactions and makes easier and develops basic skills such as dialogue and solidarity, amongst other things. The methodology and its application for education in communication systems will be discussed in this paper.

III. METHODOLOGICAL APPROACH

The opinion of the students, collected anonymously, allows us to tell whether this methodological practice is the most appropriate for the teaching development of the communication systems course, taking into account not only the assessment of the students involved, but also the final academic results of the students compared with the course records, which allows us to demonstrate objectively how the application of this methodology obtains better learning results, not only at an academic level, but also in the way the student is more involved in the learning programme and gets from it greater personal satisfaction.

IV. ACADEMIC RESULTS

Many questions have arisen and for the most part they have been assessed favourably. Equally, a small percentage shows up of students who continue preferring to develop their work in an individual way, believing that their final results will be better.

V. CONCLUSIONS

Thus, this article reflects the results of the study which justify how the application of problem-based learning and collaborative learning help the student to take on board in the most appropriate way the study material and improve their social skills.

Platform for teaching of location technologies based on Zigbee Wireless Sensor Networks by learning-through-play theory

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Abstract—In this paper an experimental Wireless Sensor Network (WSN) platform is introduced as an aid in teaching location techniques based on RSSI (Received Signal Strength Indicator) in the frame of a radiolocation course at graduate level. The platform is implemented using low-cost commercial modules and one easy-to-use software program. The teaching methodology tries to develop the *learning by doing* theory and it is completed with a final practice that implements the *learning-through-play theory*. Both techniques have resulted in positive learning outcomes by enhancing the student role in the learning process.

Keywords—component; learning through play, learning by doing.

SUMMARY

The introduction of new teaching-learning methodologies in classical areas as engineering has found large reticence mainly due to some risks supposed to innovative methodologies, such as loss of contents, incorrect timing dimensioning, not enough number of resources (labs, material ...) These and other lacks have discourage instructors.

The use of active learning methodologies results largely suitable for the teaching of technical disciplines since they facilitate that students learn both engineering processes and content knowledge. Simple experimental tests can facilitate the acquisition of most important concepts that students will need to use and apply as professional engineers after the graduation.

In this paper we present a educational platform for approaching the teaching of wireless technologies. For our case, the 2.4GHz band was selected, due to its unlicensed feature and the interest of actual applications developed in this frequency, especially the wireless sensor networks and the use of them for location and tracking applications.

A commercial kit has been used to deploy a WSN composed of a master node (MN), references nodes (RN) and mobile terminal users (TU). The TU has been developed using a commercial Zigbee module and an *ad-hoc* board that incorporates two leds, one push button, one switch and one inclinometer.

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The system was completed by programs developed in MATLAB software that allows the following functions: node setup (frequency channel, data rate, role as master, reference or mobile terminal), RSSI measurement, as well as data storage and processing processes that take place in the master node. This allows planning different experiments focused on the main concepts related to location estimation based on RSSI technique, as well as routing in a Zigbee network.

One initial practice will introduce students in the deployment of a Zigbee WSN, the location estimation according to the RSSI measurement and triangulation principle. The experiment has as goal to achieve the full operation of the WSN and the real-time estimation of the TUs, monitoring the tracking of their positions using the software tool.

After this a challenge is developed as a practical implementation of the *learning-through-play theory*: the TUs are randomly activated and distributed all over one indoor scenario, and the student teams have to determine which one of them are active and their corresponding positions.

Similar experimental systems have been previously developed regarding WSNs [1, 2], but they can be also found in the field of electromagnetism teaching as [2]. In [2] we can read the importance of the instrumentation in the radio courses curriculum and how the RF instruments and experimentation can help to emphasize signal and system theory concepts to students.

The development of innovative material as well as new methodological approaches will be a demand in the new study plans that incorporate the European Higher Education Area (EHEA) requirements for the imminent future of European universities.

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Adapting the Telecommunication Engineering curriculum to the EEES: a project based learning tied to several subjects

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Abstract—This paper describes the adaptation process to the European Credit Transfer System requirements of several subjects aiming at the Information and Communication Technologies (ICT) learning. Specifically, these subjects are sited at the Telecommunications Engineering studies lectured in the University of Valladolid. In a first step two first grade subjects have been established, while in a second and final step, coinciding with the new degrees beginning, they will be extended to five subjects placed in consecutive semesters.

The global programming has been divided into several subprojects of growing complexity, developed into subjects sited in different and successive semesters of the degree, following a pathway leading to the development of a global project throughout four years. The whole learning process is ICT-supported, as they offer tools for overcoming distance and scheduling barriers. In particular, Moodle platform is used, which has been enhanced with self-evaluation and co-evaluation tools developed by the teaching group.

Main innovation regarding to the classical approach consists of a subject programming focused on the student learning and based on the detailed specification of the activity the students have to perform in and out of the classroom in order to achieve the educational objectives of each of the subjects. The educational strategies used to accomplish these objectives are based on the cooperative learning, on the teamwork developing a programming project (Project Based Learning, PBL), and on the discovery learning. As experts state, the meaningful learning is developed when it is gained through the exploration activated by the curiosity and the desire of knowledge. The discovery learning methods provide the students with the opportunity to search, analyze, process, manipulate, transform, and apply the information.

The Project Based Learning is based on a project or plan development following the project design approach. Activities are oriented to planning a solution of a complex problem. Work is performed in teams. The students have more autonomy than in a traditional class and they used different resources. In the Project Based Learning, the teacher is not the main source of information, but he/she acts as an enabler providing resources and offering advice while they advance in their research. The students gather and analyze the information, make discoveries

and report the results obtained. The teaching and facilitation are oriented by a wide range of explicit learning objectives; some of them can be precisely focused to the specific content of the theme. The students can achieve additional goals (no planned) as they explore complex themes along different lines; they learn to learn between them; they learn how to help their partners learning; they learn peer-reviewing and giving constructive feedback both for them and their partners.

Some tools implemented as modules for the Moodle platform have been specifically designed to exploit the full potential of the PBL approach. A module called e-Liza is used for both a self-evaluation and a competitive evaluation of the knowledge gained. In e-Liza the questions are not only proposed by the teacher but also by the students. Of course, the last ones are supervised by the teacher accepting them or not, and assigning the difficulty level. Statistics of the individual or grouping play are shown to the students in order to keep them informed of their progresses. Another tool to perform questionnaires is used both for creating evaluation templates used in the peer-reviewing and for conducting surveys of the curriculum development. Students can also use other modules specially designed for each of the subjects, for example programming validators, also integrated in the Moodle platform. All these tools are very useful not only for the students making the learning process easier, but also for the teachers specially helping them in the classroom management, because this new approach add more workload than the classical one, at least in their beginnings.

Keywords: *European Credit Transfer System; engineering subjects; Project Based Learning, Moodle platform.*

**Session: 07C Area 4: Rethinking Pedagogy in Engineering Education -
Project based learning and research**

A context for programming learning based on research communities

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**Retaining electronic engineering students by project- and team-work from the
first semester.**

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**The Use of Role Playing in Engineering Curricula: a Case Study in Human-
Automation Systems**

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**A Learning Approach Based on Robotics in Computer Science and Computer
Engineering**

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A context for programming learning based on research communities

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Abstract— This paper describes a research work that seeks to develop a pedagogical strategy to assist in programming learning, inspired by Mathew Lipman’s strategy – conceived to help students maximize their learning through the conscious assessment of their self-efficacy level while they develop a programming study behaviour. We present the results of the preliminary tests on the formalization of the research methodology and the changes implied on the strategy to be tested.

Programming learning; Research communities; Literary skills; Self-efficacy

SUMMARY

Computer programming learning is known to be a difficult task for many students. Low abstraction and problem solving abilities are often mentioned as main causes for student difficulties [1]. However, we believe there is another important issue that teachers must face: how to stimulate students to get involved in the subject, and prevent them from quitting the course before the first assessment or even before they try to overcome the natural and inherent difficulties that come with learning.

Motivation is a domain of crucial importance when considering pedagogical tools and approaches to support programming learning. Several theories and tools have already been proposed to classify measure. Nevertheless, establishing learning strategies to motivate and stimulate academic performance and commitment of students has no doubt been a challenge. Nowadays a good part of youngsters face enormous difficulties to conclude basic activities of their academic life, such as reading, text comprehension and knowledge contextualization. There are many students who cannot feel motivated to didactic activities and end up not developing several literary skills and cognitive competences.

A good part of what we learn, either from will or need, involves motivation. Motivation for learning is developed through a continuous maintenance process which includes intrinsic and extrinsic strategies, ways to evaluate, stimulate or change the

individual appetite to do or not do something. It would be important to establish a set of strategies that can convince students that they are able to solve programming problems. e definition of a learning dynamics for programming courses

The goal of this paper is to describe a research that tries to define a theoretical framework that includes a set of recommendations for didactic activities, motivational strategies and computational tools that can assist the teacher in the definition of a learning dynamics for programming courses. This research has been developed in the context of the programming courses included students of University of Coimbra. It is based on a pedagogical approach to learning communities, inspired by a redefinition of Mathew Lipman’s Research Communities metaphor and aiming to help students to maximize their learning through the conscious assessment of their self-efficacy level, while they reinforce literary skills and develop study behaviour for programming. Literary skills can be reinforced together with the capacity to solve problems, namely when students develop abstraction and algorithm modelling abilities.

The Programming courses are structured according to a Research Communities based dynamic that includes: 1. Pedagogical context and learning tasks; 2. Tools to support learning and team work; 3. Strategy to develop and maintain student motivation levels. In order to assess the results, the proposed strategy uses some formal psychological tools to check the change of several cognitive aspects related with motivation: a survey about students study behavior, an evaluation of the satisfaction levels with the accomplished tasks, and the measurement of the self-efficacy levels of students.

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Retaining electronic engineering students by project- and team-work from the first semester

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Abstract— This paper describes the experience of teaching the basics of engineering: calculus and the basics of physics as part of a project- and team-work initiative in the department of Electronics and Information Technology, at Copenhagen University College of Engineering (CUCE) in Denmark. All the basics courses in the first and second semester have been taught as part of projects and involve teamwork. Modern engineering students are difficult to motivate in order to learn pure theoretical issues such as solving differential equations. Especially when we talk about undergraduate engineering students, who do not expect to continue their education higher than a Bachelor of Science in Engineering. At the same time, and for the same reason, the fail rate in mathematics is very high during the first two semesters. This was the reason we decided to change the structure of our education and incorporate the theory with practical projects. This paper describes some of the projects. The projects are the motivating factors to learn mathematics. The examination results show improved learning potential, when using this method of engineering education. The students' evaluations show a very positive effect on their experience with this "practical" way of learning theory. At the same time, the evaluation results have shown higher pass rates and higher grading.

Keywords - Motivation, Project based learning, Teamwork

SUMMARY

The research confirms improvement of the learning outcomes in education when the theory is combined with practical training on projects. Students who wish to work professionally with electronics, computers and telecommunication, and who do not wish to continue for Master Degree, are not motivated to use 2-3 semesters for pure theoretical studies. These students usually have high fail rate in mathematics and physics in the first 1-2 semesters and, as a result, many of them stop. On the other hand we must introduce the theory in order to understand and work with a number of complex engineering disciplines.

Problem-based learning and working with projects has already been implemented in engineering educations in many different universities. This paper presents how we implemented the calculus and the basics of physics in the curriculum for undergraduates, as a part of projects in the first two semesters.

In Chapter II we present the study structure of our Bachelor program in Electronics and Information Technology, involving team work and project-based courses. In Chapter III we present more details about our courses in Mathematics during the first three semesters. We describe how the theory is connected with projects, teamwork and use of the computational and simulation tools like MATLAB and SIMULINK. The mathematics curriculum is described for the first three semesters and there are examples of the projects of the second and third semesters.

In Chapter IV we describe our examination process, for project related courses. The examination is both group- and individual- examination, but the marking is always individual. The evaluation is based on a general impression of the level achieved by the student relative to the objective of the project based course. We use both internal examiners, the teachers connected to the particular course, and the external examiners, the teachers from other universities or specialists working in the industrial companies.

In Chapter V we describe students' evaluations. Students make evaluation of their courses twice during the semester, in the middle of the semester and after the examination. The final evaluation, after the examination, is made on CampusNet, which is our intranet, and the results of this evaluation are available to the students participating in the course, the teachers and the head of the department.

In Chapter VI we make the conclusion, that the main objectives of changing the structure of our Electronics and Information Technology program have been achieved. The students have got a better understanding of the mathematical tools in engineering and the drop-out rate has been reduced.

The Use of Role Playing in Engineering Curricula: a Case Study in Human-Automation Systems

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Abstract—This communication presents a collaborative experience between four Spanish centers: the School of Engineering (ETSE) and the Sports Services Area (SAF) both from the Universitat Autònoma de Barcelona (UAB) jointly with two centers of the Technical University of Catalonia, the high school from Vilanova i la Geltrú (EPSEVG) and the high school in Terrassa (ETSEIAT). The idea behind this collaboration is to explore the possibility of role engineering education and project development for engineering students. The basic principle of such projects is the identification of the corresponding roles associated with the different parts that can be found on current social/industrial activity.

Keywords—component: role-playing; project-based learning, effectiveness and satisfaction metrics

SUMMARY

The Role Playing is used in our work as a methodological tool to provide students an appreciation of the range of issues and problems associated with engineering requirements in a real framework [1]. The Role Playing strategy is a successful tool used, for example, in software engineering education. The Role Playing is used in our work as a methodological tool to provide students an appreciation of the range of issues and problems associated with engineering requirements in real settings [1], [2]. An integrated framework is developed in order to improve the relationship between the Role Playing strategies inside the educational theory of Technological Pedagogical Content Knowledge [3]. One interesting approach is to establish a relationship between the use of the role playing approach and the realization of an engineering project. Among all possible different engineering curricula that can be found around (see [4] for a few examples) it is recognized the value of hands-on experiments and realization of project courses. Effectively, the realization of a project, usually during the last year of the degree, allows the student to face with a somewhat large problem where he/she has to be able to tackle the analysis and design stages as well as considerations on technology for implementation. The motivation for this communication is to show how opportunities for real world control and automation applications can be found on the immediate student environment.

This paper presents the application of the Role Playing methodology in engineering classroom from the point of view of an industrial automation case study.

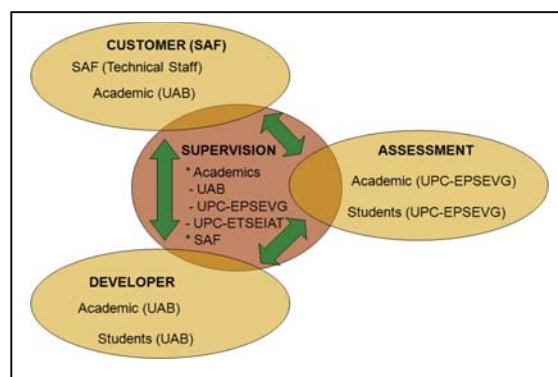


Figure 1. Identified roles and interconnection between partners

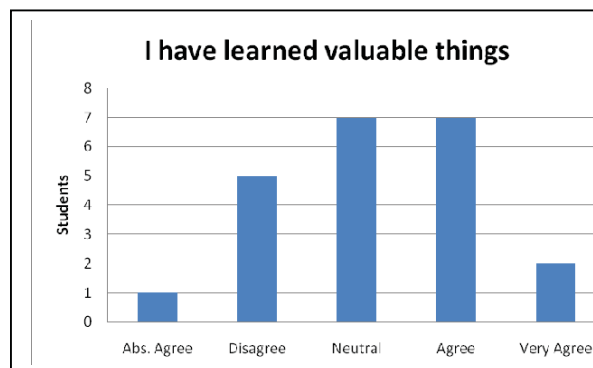


Figure 2. Inside the SEEQ “Learning” category (question two)

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A Learning Approach Based on Robotics in Computer Science and Computer Engineering

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Abstract—It is well known that the number of students that arrives to engineering studies decreases every year, due to the difficulty that these studies present, when compared to other studies, in a society that tends to be more social oriented than in the past.

In order to increase the interest of the students this paper presents a Project Based Learning (PBL) that involves hardware and software using the robotics as the main object in computer studies. This educational project is being held in the Computer Science and Computer Engineering studies of the *Universitat Autònoma de Barcelona*.

Keywords-component: Project Based Learning (PBL), robotics in computer science.

I. STATE OF THE ART

The use of robotics for teaching purposes has motivated several generations of professors and students in computer studies. In 1994, Pattis et al. presented *Karel the Robot* [1], a simulator to introduce programming techniques. From there up to now, several companies have introduced in the market excellent robot kits for education as Lego Mindstorms [2], Sony with Aibo [3], etc, based on robots that are programmed using specific tools. More recently, the Institute for Personal Robotics in Education and Microsoft presented the Myro robot [4] with an educational environment that has been extensively used to introduce students in engineering studies. Also, several authors [5] [6] have argued the use of robotics as a means in order to help the student in programming courses.

Until now robots have been extensively used in learning stages as a resource to improve teaching results, but rather limited to specific areas of knowledge. The robot, as a whole, is a powerful tool that can be used in transversal teaching processes. The technological power that a robot presents has not been used as a whole in computer studies.

A. A PBL based in robotics in Computer Science

The paper shows a transversal experience that uses the power of robots in a learning process in computer studies including hardware and software subjects. The subjects are

introduced in a way that students are confident with what computer studies imply despite the use of the robot.

Of course, a PBL based on robotics in computer studies can include many topics comprising subjects from the first year to higher level courses. Robotics embraces all the computer engineering and computer science knowledge [7].

In this experience, the authors have used robotics in the first course as a resource to motivate the beginner students. In this sense, the robot has been used to introduce, hardware and software topics. The experience developed includes the subjects of fundamentals of computer engineering including low level programming (assembler), algorithms and high level programming and data structures.

The paper presents the experience that is being developed in our university. The paper begins with a discussion in section two of the first course syllabus in computer studies and its adaptation to a robotic-based PBL. Section three introduces the scheduling of the reported experience. The setup and cost of the experience is discussed in section four. Section five describes the PBL application and results obtained and, in the end conclusions are presented.

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Session: 07D Area 2: Laboratory Experiences: on-site and remote environments - On-line Labs

NETLAB: Online Laboratory Management System

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Reconfigurable weblabs based on the IEEE1451 Std.

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The Montegancedo Astronomical Observatory. The first free remote observatory for learning astronomy

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NETLAB: Online Laboratory Management System

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Abstract — An online laboratory management system is described. In this article, we report on the design, realization and use of an educational hardware-based real time online laboratory for students in the area of microelectronics and VLSI engineering. The developed management tool is capable of user management, authentication and authorization as well as experiment data storage and retrieval.

Keywords-online laboratory, laboratory management system

I. INTRODUCTION

Laboratory-on-Demand (also known as online or internet laboratory) is becoming one of the most popular and progressive avenue for expanding laboratory education at anytime from anywhere. An online remotely controlled MOS capacitor experiment has recently been implemented by Pandey et al. [1] at the Indian Institute of Technology Kharagpur and student responses have been assessed. In this article, we report on the design, realization and use of an online hardware-based real time laboratory for students in the area of microelectronics and VLSI engineering. The basic idea is to have a general purpose, reconfigurable software module that can be used to control different instruments and organize and manage students' laboratory sessions.

There have been a number of different approaches to develop management tools for online laboratories. Management of an online laboratory requires at least the followings:

- Experiment scheduling
- Delivery of assignments
- Publishing of the laboratory reports
- Remote interaction between users/teacher
- Review (viva voce) and assessment

The online laboratory management system NETLab described below is a system to manage the student's record and performance in their respective laboratory courses. The system keeps record of each student and the detail of the performed experiment. The system also has administrative privileges to review and rate the student performance. Any new experiment can be incorporated very easily. The system is designed to perform on a web-based platform to eliminate the requirement to set up expensive infrastructure.

II. SYSTEM DESIGN AND OPERATION

The NETLab uses the java server pages and Java servlets as the means to design web pages. The back end consists of Oracle 10g. This system uses JDBC connection to build a connection between the java interface and the database. The

Apache Tomcat 6.0.18 is used as the application server that generates the web pages according to the user commands. The front end is a computer with a java-enabled browser such as Internet explorer or Mozilla Firefox. The system has a special interface that connects to the hardware. These interfaces are built using the web development tool of NI LabVIEW 8.5. The devices are connected and controlled by using the interface and their corresponding drivers.

Each user need to have a username and a password as well as a profile stored in the database. The user has to log in and select a particular experiment. Each experiment has the following features: a laboratory manual, description of the experiment, experimental procedure, etc. As the system works in a batch mode, it distributes the time in slots and each user has to select and choose a particular time slot for performing the experiment. However, the experiment manuals etc. are available all the time. The student logs on to the system to gain access to the laboratory and gains full control of the laboratory hardware. The user can adjust experimental parameters or submit new commands in real time. After performing the experiment the user has to upload a laboratory report and has to take part in a viva session for evaluation purposes. Each user can perform the experiment again if not completed in one session. Screenshot of the login page is shown below.



III. CONCLUSION

The work presented here aims at defining a standard approach for the development of online laboratory management system.

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Reconfigurable weblabs based on the IEEE1451 Std.

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Abstract— Widespread of weblabs in education depends on guaranteeing flexibility, reusability and reliability to run different remote experiments. We discuss current problems associated with weblabs, concerning those aspects, and a direction for solving them, namely through weblab infrastructures compliant with the IEEE1451 Std. and implemented with reconfigurable devices.

Keywords: E-learning, Remote experimentation, Remote laboratories, Reconfigurable weblabs, IEEE 1451.0 Std.

The evolution of internet speed and computer performance promoted the widespread of e-learning platforms (e.g. Moodle) to deliver contents and tools to improve education, namely the teaching and learning processes. These platforms are complementing and improving the traditional classrooms and are currently being applied in many countries, contributing to easily involve all actors (from teachers to students), overcoming costs issues, time constraints, promoting the collaboration among different cultures and enabling more “learn-by-doing” increasing student’s motivation [1]. Since e-learning platforms do not include the ability to conduct practical work required in science & engineering courses, several efforts have been made for creating the so-called weblabs that enable running real experiments through the internet, using a PC. Many weblab infrastructures were developed [2], however they follow specific and distinct technical implementations, with several hardware and software architectures (typically based on PCs), using different programming languages. The lack of a standard solution decreases the wide-spreading of weblabs since:

- it does not promote collaboration among institutions, because it is difficult to reuse and interface different instruments/modules used by a specific experiment;
- some institutions do not develop weblabs for supporting their courses, because they don’t have the required technical skills;
- costs may be high, since creating a weblab infrastructure requires a PC and associated software, together with several instruments;
- an architecture based on a single PC, poses constraints for running different experiments, and the required software layers usually create actualization problems due to non-compatibility issues between versions.

To overcome these difficulties we propose a solution based on reconfigurable devices able to accommodate several instruments/modules developed with open standard hardware description languages, following a structure and interface defined in another open standard. This solution relies on FPGA-boards,

concurrently available on the market, supporting a wide range of peripherals (A/D + D/A converters, interface ports, etc.) and the capacity to accommodate different instruments/modules, eventually in parallel, depending on the FPGA complexity, and hence on its cost. The instruments/modules should be described using the standard hardware languages VHDL or Verilog to guarantee manufacturer independence and a reliable operation (not depending on software layers), and their specifications should respect the IEEE 1451.0 Std., which defines a set of open, common, network-independent communication interfaces [3]. Besides facilitating the interface of those instruments/modules into different experiments, collaboration and the implementation of remote experiments in technical courses will be enhanced, as no high technical skills are required to create a weblab infrastructure (a simple reconfiguration procedure should be applied). Costs associated with the instrumentation will be reduced, because they may be integrated into the FPGA-board, providing only the required features for a specific experiment. To solve typical concurrent accessing problems, researchers have been proposing the use of booking systems [4], and solutions for running experiments in batch or real time modes [5]. FPGA reconfiguration techniques (total or partial - static or dynamic-), besides allowing to change the experiments using the same FPGA-board, also allow to solve accessing problems when 1 to N students want to run 1 to N experiments as represented in the figure.

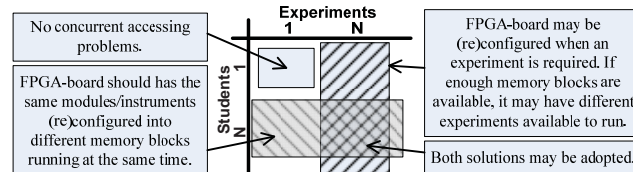


Fig. Solutions to run 1 to N experiments for 1 to N students on a single FPGA-board.

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The Montegancedo Astronomical Observatory

The first free remote observatory for learning astronomy

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Abstract—This paper describes the first open robotic observatory available to the public on the Internet (<http://om.fi.upm.es>), interactive and completely free access through a Web 2.0 application, which lets users manage professional astronomical devices and collaborate with other amateur users through a web browser. Its main goal is to open the astronomy to the society and that people learn informally about the cosmos by means of experimenting with real remote devices.

This is called Montegancedo astronomical observatory and is located at Madrid, Spain, at the roof of one building of the Faculty of Computer Science. From December 2008 up to now, the first remote experiment through the Montegancedo observatory is running. The experiment lets users watch the Sun and control a high-quality professional camera for astrophotography. It is worth mentioning that, dated August 2009 (only nine months running), its community is composed by a total of almost 600 users.

The software and hardware architectures developed are described here. The software which controls the Montegancedo observatory is called Ciclope Astro, whose development is hosted by SourceForge as a free software project. For the time being, the same methodology and software are being adapted also to another observatory, called TAD (Open Dissemination Telescope), located at El Teide, Canary Islands. This is the second open observatory, with the advantage of being located in a high quality astronomical place. However, it is expected this architecture will be used by any other robotic observatories. Besides control interfaces to manage the telescope and other astronomical devices, like cameras or domes, this architecture is made up by common collaborative web 2.0 tools (such picture gallery, wiki, forum, chat, voting and discussing systems, etc.) and services and policies to offer meritocratically the observatory and its observing time.

Mainly, the methodology proposed relies on a meritocratic functioning where users have to get observing time according to their demonstrated collaboration and participation in the community for carrying out astronomical experiments. That is, the more and better collaboration, the more observing time. It is an interesting computer science problem, never analyzed up to now. The paper presents an innovative approach which proposes a reputation system for sharing an online resource to encourage high-quality contributions.

The social network for learning astronomy around the Montegancedo observatory is analyzed from beginning. The methods of analysis are explained in detail and, as it is shown, are very suitable and decisive methods to find out the behavior of large communities and the impact on society. Furthermore, the paper presents the visualization tools used to watch interactions among users and to determine relevant factors like the network structure and the most popular users. Also, initial outcomes obtained since the observatory started are shown, for instance the proportion of users by gender and age, common users' actions, access statistics and problems encountered, among other contributions.

This paper also describes the first experience using the observatory for carrying out online practical assignments in an Educational Innovation Project within the Technical University of Madrid during academic year 2008-2009 and using it for three subjects of these different careers: Computer Science, Industrial Engineering, and Topography. The name project is "Execution of remote collaborative practicals with the Montegancedo Robotic Astronomical Observatory. Application to the subjects: Geodetic Astronomy, Computer Vision, and Design for Web Applications".

Finally, the future research and plans are exposed, from an ambitious aim of creating a network of free access observatories around the world, to specific astronomical citizen science projects.

Keywords—informal collaborative e-learning; meritocracy; social networks; web 2.0; web laboratories

Session: 07E Area 5: Attracting and Retaining practices in Engineering Education

The Role of Superior Education Institutions on Post-Secondary (Non Superior) Education

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Action Research: A Way to Generate New Approaches to Teaching Mathematics in Bioengineering

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Developing and Evaluating a Game-Based Project Management Learning Platform

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Efectiveness of a Peer Mentoring Program in Engineering Education

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The Role of Superior Education Institutions on Post-Secondary (Non Superior) Education

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Abstract — The Portuguese Government developed specific legislation to attract new students for the technological higher education system, and to improve technological specialization after the secondary school level.

Post-secondary non superior technological specialization courses creation leading students to obtain level 4 of professional training, also allow the best students to access higher education in technological domains (basically in Engineering fields) and/or to the job market relied with the country's technological industries.

A partnership between the Association for the Technological and Professional Formation and the University of Minho to encompass this post-secondary education is discussed and highlighted.

Keywords: Engineering Education; Professional Training; Higher Education

SUMMARY

In the late seventies in Portugal the “Industrial Schools” have been extinct, under the assumption that equal opportunities meant a uniform non technical secondary level formative path for everybody. This transformation led to the rarefaction of technical teaching and to the depreciation of the status of technical professions. To compensate the lack of technicians with formal instruction for the available jobs, industry used to hire apprentices, most of the time in situations that configure nowadays illegal infantile work.

By the beginning of the nineties the shortage of skilled technical professionals reached a level that could no longer be ignored. The Technological Specialization Courses, TSC, creation presents advantages for the youth by providing a strong technological component, lectured by competent technicians.

By 2001 the AFTEBI, Association for Technological and Professional Formation, invited the University of Minho, UMinho, to establish cooperation in the formation of intermediate level professionals for the industry in various knowledge areas, in order to take advantage of the University human resources and infrastructures and to grant the prosecution of studies of the AFTEBI graduates in the 1st cycle superior courses promoted by the University of Minho.

As a strategic University, UMinho intends to attract the best students in all the domains. In the particular case of Mechanical Engineering, a TSC on Industrial Maintenance, constitutes an interesting possibility of having students with a practical background supported on competence-based education concepts [1], highly focused on the Bologna declaration [2].

It must be stressed that the University is responsible for the scientific preparation of the bulk of the teachers of the learning system, but the research activities committed to the Universities in Portugal are also responsible to foster development, in particular in technical issues.

The University must be involved with the forming entities and the companies in the definition of the global objectives to reach and activities to develop, and also in the assessment of the Courses, in order to assure the technical quality of the formative proposal, its coherence and robustness.

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Action Research:

A Way to Generate New Approaches to Teaching Mathematics in Bioengineering

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Abstract— Bioengineering, a relatively recent engineering branch, was launched 24 years ago in Argentina at our university (Universidad Nacional de Entre Ríos). The undergraduate program aims at providing solutions to health problems through the application of advanced technology. Consequently, a highly skillful professional is required. However, learning deficiencies and difficulties have been observed among first year students. Action Research was chosen as a research tool to generate new approaches to teaching mathematics in Bioengineering.

Keywords: *Biomedical Engineering Education – Action Research – Teaching/Learning Mathematics for Bioengineering*

I. INTRODUCTION

The project is being carried out within the bioengineering undergraduate program at the Faculty of Engineering (Universidad Nacional de Entre Ríos). In Latin American countries, both established and modern techniques are in use, so universities must offer courses of study designed to develop creative engineers capable not only of understanding the new technologies but also of adapting them to the true needs of society. Mathematics is a developing field which should provide students with background knowledge to undertake specific problems and contribute to the development and strengthening of cognitive and metacognitive abilities which will favor autonomous learning [1].

II. MOTIVATION

Two opposing issues triggered this research project: on the one hand the demanding professional requirements imposed on bioengineers and the goals of the mathematics courses in the syllabus mentioned above and, on the other, the complex issues concerning students who have entered university. An analysis of students' withdrawals shows that different factors interact to influence this complex phenomenon: homesickness, vocation conflicts, socioeconomic problems, insufficient schemata, poor or bad study habits, among others. In the mathematics class, there is evidence of problem-solving, reading comprehension and academic writing problems that are then reflected in low marks. During the past five years, more than 55% of the students were bound to retake the course. These worries were the starting point for the formation of an interdisciplinary group whose members study the above stated problems in a group of

second-year students who are taking the subject Vector Calculus and Differential Equations.

III. METODOLOGY

The team is constituted mainly by mathematics specialists who teach the subject and by teachers from the Languages and Social Sciences Department and a pedagogical assessor from the Faculty of Engineering. Action Research was chosen as a research tool. This approach can be defined as the study of a situation in order to enhance action in the community. From this point of view, every teacher is a researcher as this method is not so much something that we do in addition to our teaching as something that we integrate into it. Action Research is structured in spiral cycles which are divided into four classic developmental phases: the initial exploration phase, the planning phase, the action phase and the reflection phase which generates a new research cycle [2]. In the first phase we detected that assessment is one of the factors that most influences the choice of strategies in students in concordance with other research. Thus, we have started to redesign assessment and to consider it as part of the teaching-learning process. According to this formative assessment perspective, we include activities to foster self-regulated learning and computer laboratory work.

IV. RESULTS AND CONCLUSIONS

The results of the 2008 academic year were good as only 11% of the 66 students who had enrolled had to retake the course. But this is only the beginning of a spiral process. New hypotheses have arisen to continue the process and to overcome the system's natural opposing forces. Action research is one way engineering educators can build the bridge between improving student learning and their own professional learning as teachers and teacher-researchers.

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Developing and Evaluating a Game-Based Project Management Learning Platform

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ABSTRACT

Project management is a complex task, where individual learner in a team group needs to study the challenge of design, problem solving, decision-making and formulation of the work. To learn project management for facilitating learners, this study develops a game-based project management learning platform of project management. A game-based technology learning model is proposed in this paper based on the flow theory, technology acceptance model (TAM), and social learning theory. This model can be evaluated the playfulness, usefulness, learning attitude and self-learning efficacy during the learning platform of the project management for learners' learning. In the academic context, this study thus can verify the rationality in game-based technology learning model, and value the effectiveness of learning in learning project management. In practice context, this study can establish necessary criteria for conducting the game-based learning platform in enterprises, and so it can understand the enterprises applying game-based technology in the promotion of staff training.

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Effectiveness of a Peer Mentoring Program in Engineering Education

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Abstract— The Mentoring Program of the *Escuela Técnica Superior de Ingenieros de Telecomunicación (ETSIT)* is intended to establish a mechanism based on peer mentoring provided by upper-class students (*Mentors*) to provide help, support, and resources to incoming first-year students (*Mentees*). This paper focuses on the experience gained in the creation and development of the ETSIT Mentoring Program during five years.

Keywords—engineering education; engineering student retention; peer mentoring;

SUMMARY

Nowadays, with the number of students entering engineering degrees programs declining, it is important to focus efforts not only on attraction, but also on student retention. In this sense, student support during the transition to university is one of the main influences on whether a student stays or leaves. The challenges for someone transitioning from high school to university can be significant. These challenges can be even greater when the student is entering into engineering. As a support mechanism, successful peer mentoring can significantly impact students' desire to remain in engineering and at the university [1].

The Mentoring Program of the *Escuela Técnica Superior de Ingenieros de Telecomunicación (ETSIT)* from the *University of Las Palmas de Gran Canaria (ULPGC)* is intended to establish a mechanism based on peer mentoring provided by upperclass students (*Mentors*) to provide help, support, and resources to incoming first-year students (*Mentees*) throughout their first semester of the university on a range of academic, social and administrative issues. This peer mentoring program has been in existence since 2004 and has proven to be successful promoting student involvement and enabling success in *Mentees'* academic, social, and personal endeavors, as soon as developing in *Mentors* professional and transferable skills to take into engineering practice. More generally though, the ETSIT Mentoring Program helps to develop an identity as an engineer in both the *Mentors* and *Mentees*.

This paper focuses on the experience gained in the creation and development of the ETSIT Mentoring Program during

five years, giving a detailed description of the program, the logistics involved in its implementation, or the modifications introduced throughout its successive editions to improve their key elements—including the selection and training of *Mentors*, the organization of the *Mentor* and *Mentee* meetings, and the topics to be covered in order to provide the right support at the right time, or the content of the reports that the *Mentors* have to complete after each meeting—.

The evolution of the results obtained from the *Mentor* and *Mentee* satisfaction evaluation of various aspects of the ETSIT Mentoring Program, are also presented. In this sense, *Process Evaluation* is a crucial part of any effective mentoring program as it provides information to increase its effectiveness through a feedback/continuous quality improvement process [2]. The Process Evaluation of the ETSIT Mentoring Program involves anonymous satisfaction surveys completed by both the *Mentors* and the *Mentees* after the fall meeting. These surveys have been elaborated as part of the activities of a mentoring network in university environments which includes most of the universities developing mentoring programs in Spain, including the University of Las Palmas de Gran Canaria. The elaboration of these common surveys has allowed the comparison of the results obtained from different universities on the same issues. However, as various issues covered through the implementation of mentoring programs are not directly used during the first semester of the university, and in many cases the incoming first-year students don't have an adequate temporal perspective to value all the aspects in which the mentoring program have influence, the ETSIT Mentoring Program also involves a anonymous satisfaction surveys completed by *Mentees* after staying three years at the university in order to evaluate their perception about the effectiveness of the mentoring program on that period.

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Session: 08A Area 1: Learning Systems Platforms and Architectures - Virtual and Remote Labs

GILABVIR: Virtual Laboratories and Remote Laboratories in Engineering.

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Integration View of Web Labs and Learning Management Systems

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VirtuaLab, a Teaching/Learning System for 8 and 32 bits Microcontrollers

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Implementation of a virtual communications laboratory for e-Learning

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GILABVIR: Virtual Laboratories and Remote Laboratories in Engineering.

A Teaching Innovation Group of Interest.

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Abstract—GILABVIR (Grup d'Interès en Laboratoris Virtuals i Remots) is a recently created Virtual and Remote Laboratory Group of Interest at the UPC (Universitat Politècnica de Catalunya) and it is integrated in a more general teaching innovation project: RIMA [1]. RIMA has been developed to promote research on the use of innovative learning methodologies applied to engineering education and it was specially created to assess in the new European higher education adaptation process.

Keywords: transversal skill, digital campus, software platform, laboratory experiment.

SUMMARY

The GILABVIR Group is formed by high education faculty members who are involved within different laboratory courses, all of them characterized by the use of real and simulated experiments accessed through a moodle based digital campus platform (ATENEA). All the experiments in the different laboratory courses are developed following the next three steps sequence: 1.- The student designs the experiment and configures the parameters on-line, either at distance or in the computer classroom. 2.- The experiment is executed. 3.- The different results (numerical, graphical, images, etc.) are displayed and optionally recorded at the student computer and are also optionally recorded at the ATENEA server.

A dedicated software tool (Moodle_LAB) has been programmed in order to control and monitor the access and execution of an experiment. With this option, professors can enable or disable the access to each experiment offered in each course and can also obtain information, individually for each student, about the timing, the configuration parameters or the obtained results. These data are used to evaluate the students. For most of the virtual and remote laboratory based learning activities, professors can obtain automatically a list of numerical results and records.

Since GILABVIR started, one of the major challenges for the group, consist in the design of on-line based activities addressed to provide students with generic skills. Concentration efforts have been done to specially reinforce the skills listed following: 1 Cooperative learning, 2 Experiment behavior and knowledge of instruments, 3 Autonomous learning, 4 Identification, formulation and solution of engineering problems.

Up to date, there are nine laboratories integrated in GILABVIR and they are used in courses corresponding to curricula of: Electrical Engineering, Computing Engineering, Industrial Engineering and Civil Engineering. Technical and didactic aspects of them have been collected and classified.

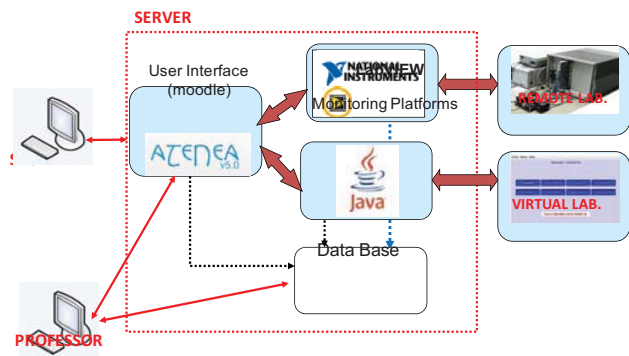


Figure 1. Remote laboratories and Virtual Laboratories are connected to the server through a software platform: Java or Labview. Atenea is the user interface (UPC Digital Campus).

Paper Outline—The rest of the paper, is organized in five sections. After an introductory section I, section II is dedicated to define virtual laboratories and remote laboratories, emphasizing the differences and comparative features between them when they are used for learning activities. The virtual and remote GILABVIR laboratories are described. The design and functionalities of the monitoring tool: Moodle_LAB are described in section III and represented in Figure 1. In section IV innovative teaching methodologies based on these laboratories are presented and related to a generic skill list. Finally, the conclusions are described in section V.

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Integration View of Web Labs and Learning Management Systems

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Abstract— the integration of Learning Management Systems and specific learning support applications known as Web Labs (remote and virtual laboratories) are the target of a new wave of service-oriented applications devoted to improving on-line learning experiences.

Keywords-- e-learning; Learning management system; remote Labs, virtual labs, iLabarchitecture, e-learning standards; Web services. component; formatting; style; styling; insert (key words)

SUMMARY

This paper discusses the need for merging several e-learning solutions into one. At present there are a great number of universities that are using blended learning or distance learning in parallel with traditional learning. In the case of distance learning, it is necessary to change and apply distance learning methods so that students achieve both theoretical and practical knowledge. To achieve this double goal, there are two new solutions particularly designed for distance learning:

- A learning management system (LMS) is a software program that enables the display of theoretical content in an organized and controlled way. LMSs offer a set of features and services: user administration, e-learning standards (SCORM, IMS-QTI), content packing, etc.
- A web lab is a program that allows students to execute experiments remotely using a PC and an Internet connection. There are several ways to implement a web lab:
 - Software Lab. They are simulation programs and are executed locally on the student's computer. There is no collaborative work, and students do not work with real instruments or hardware.
 - Virtual Web Lab. These are simulation programs that use web resources. They permit students to collaborate during the execution of experiments.
 - Remote Lab. A remote lab allows the student to manipulate real instruments over the Internet during the run of an experiment.

Many universities are developing their own virtual and remote labs, but these efforts lack a unity of design, involve much custom development and present integration issues. There is little to no reuse of software between these efforts; each is developed from scratch. As one solution for this problem, the Massachusetts Institute of Technology has implemented the iLab Shared Architecture (ISA) to facilitate the rapid development of new web labs and to provide a mechanism so that students from one university can use experiments and hardware instruments published from another.

While the ISA solves many problems, it does not offer the standard features supplied by learning management systems (e.g., chat, forums, learning modules). If you want these features in a current iLabs, you must program them into each lab's software. In this article we define a common architecture and middleware for adopting these typical LMS services as e-learning standards. We also illustrate the merger of theoretical and practical learning in a particular solution.

Thus, in this paper we will focus on two topics:

- We describe a technique to present a web lab through a browser delivered by an LMS as a part of SCORM standard packaging. The LMS will provide the web lab's communication, administration, and authentication tools. Of course, the lab can invoke the SCORM API so that the teacher can monitor the student's progress. When implemented as SCORM standard packages, web labs can be deployed in different LMSs such as Moodle, .LRN, Claroline, Sakai, etc.
- While the ISA provides an excellent management infrastructure for online labs, we argue that we need a service-oriented fusion of this architecture with general LMS services, compatible with multiple LMSs (Moodle, .LRN, Claroline, etc.) to supply the full functionality needed by educators.

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VirtuaLab, a Teaching/Learning System for 8 and 32 bits Microcontrollers

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Abstract— This paper describes the current state of the VirtuaLab facility at the Universidad Carlos III de Madrid. Under an authenticated access, the system allows to control a microcontroller based modular system, with visual feedback to the remote user through a web camera. VirtuaLab allows control through Internet of the same laboratory resources used on-site sessions from inside and from outside the campus area.

Keywords-virtualab; e-learning; microcontroller; ARM7; 8051

SUMMARY

VirtuaLab is a modular system which can be used both into on-site sessions, and also from Internet using a software application which gets the total control of the PC based development platform, located into the real laboratory.

The developed platform is flexible enough to integrate available commercial evaluation boards, so avoiding microcontroller obsolescence and easing the migration to new models with low effort, [1]. We use a project based learning approach, as other authors have followed before, [2].

The system can use any microcontroller of 8, 16 or 32 bit, usually included onto a commercial evaluation board. The actual system built use the evaluation kit C8051F226DK from Silicon Laboratories, derived from the Intel 8x51 design, and the Keil MCB2100 kit, based on a 32-bit ARM7 CPU.

We have designed the board E/S MICROS in order to have control of some peripherals. The different interfaces use a specific I/O pins assignment and routing board for each one of the microcontrollers. This passive pin adapter board allows the connection of the evaluation board to E/S MICROS.

Actually, we are using IDE from Silicon Labs and μ Vision3 from Keil/ARM as development environments, which include tools that let to edit, assemble, compile and link programs, and then run and debug it when they are errors' free.

The E/S MICROS board includes a keyboard/keypad, an LCD liquid crystal display, a LED's matrix, an RS-232 serial port, an I²C EEPROM and I²C potentiometer, an infrared receiver, and a triac for AC phase control.

An expansion board adds to this E/S MICROS some peripherals, placed outside because of space constraints.

These are a little speaker, a power relay, a DC motor and a photo detector of the motor axis spin.

Also included is a webcam of 640x480 pixels resolution and maximum rate of 30 fps and an auxiliary lamp. In this application, we do not have special video bandwidth requirements.

The management and control software of VirtuaLab has been developed under Delphi. It uses the Windows Remote Desktop to access from Internet an on-site laboratory PC. The system authenticates the user to verify its access rights, and then he can work up to a maximum allowed time of 1 hour.

On the client side, the user needs an Internet connection, but not a high-speed link. The access can be done from inside the campus or from outside, for example from the own home.

The major perceived effect of VirtuaLab is an increase of the time students spend working with the microcontroller platform. Other studies as [3], have not detected any significant difference of results between remote and on-site labs of similar contents, in agreement with VirtuaLab findings.

From the point of view of instructors and school management, there are significant gains in terms of time and resources assigned to classroom training, as more students can progress by auto learning, without close teacher attention.

As a dedicated system, VirtuaLab control a broad range of peripherals, is flexible to avoid obsolescence, and manage the students working time, all of these maintaining the same HW platform used in an on-site lab.

However, as the market brings cheaper boards and link dongles, the use of low cost individual trainers could become an alternative to such dedicated systems.

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Implementation of a Remote Analog and Digital Communications Laboratory for e-Learning

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Abstract--Rapid changes in the field of engineering technology have increased the need for universities to provide engineering and engineering technology students with meaningful and relevant practical experiences; however, limited available resources in the provision of laboratory hardware and infrastructure have been the principal impediment in achieving this objective. Such hardware limitations have been increasingly marginalizing the quality of engineering and engineering technology education.

Keywords; *Remote, Analog, Digital, E-learning*

I. INTRODUCTION

Remote laboratories allow students around the world to log into a computer equipped with the suitable interface circuits, such as data acquisition systems connected to various sensors or communication modules, and perform real-time experiments. In this paper, we propose the use of a computer-controlled switch matrix with the Emona DATEx trainer and the ELVIS II platform in order to eliminate the need for user presence in the lab to perform the RF connections needed to perform Analog and RF communications experiments.

The first component in the proposed remote lab setup is National Instrument's Educational Remote Instrumentation Suite (NI ELVIS) [1]. In addition to its built-in instruments, the NI ELVIS can be used to build LabView-based remote instruments, a multifunction data acquisition device and a custom designed bench top workstation and prototyping board. The second component in the proposed remote lab set-up is Emona's DATEx trainer [2], which is a plug-in module for the ELVIS II platform. The DATEx-ELVIS II bundle, shown in Figure 1, enables the use of a hands-on approach in teaching engineering communications concepts. However, experiments can't be remotely performed using LabVIEW.

II. REMOTE LABORATORIES

A growing body of work has appeared that has further validated both the technological viability of distance laboratories and their effectiveness in delivering a worthwhile laboratory experience. Limitations on

equipment access and funding reduce the availability of laboratory resources in many institutions. Remote labs help alleviate this problem by increasing access and simultaneously reducing cost.

III. EMONA'S DATEX COMMUNICATIONS TRAINER NATIONAL INSTRUMENT'S ELVIS II EDUCATIONAL PLATFORM

The DATEx trainer is a plug-in module for the ELVIS platform. The DATEx-ELVIS II bundle enables us to use hands-on approach in teaching engineering communications concepts remotely using LabVIEW. We will show that by using the DATEx-ELVIS II-based remote laboratory, as shown in Figure 1, students can log in and generate their own AM/FM/BPSK signals, set up a bandwidth limited signal and explore its spectral composition, and much more. In addition to providing online laboratories, this remote laboratory will be an ideal venue for on-line instrument evaluation.

CONCLUSION

In this work, we presented a setup that can be used to perform modern RF and Digital communications experiments remotely in a distance learning environment. In this model, a switch matrix is used to eliminate the need for students to be present in the lab. This setup, combined with the remote nature of the process, allows for a highly cost effective and pedagogically rigorous mechanism of instructions for students in situations where traditional laboratory equipment is either unavailable or at a premium cost.

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Session: 08B Area 4: Active Learning - Methodologies and analytic studies

Bringing the everyday life into engineering education

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Use of E-Learning functionalities: results of a survey along Spain

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Active Learning in Power Electronics

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**Learning engineering by teaching engineering in the European Higher
Education Area**

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Bringing the everyday life into engineering education

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Abstract— To successfully design and engineer solutions for today's and tomorrow's rapidly changing and expanding global contexts, in which people are confronted with new opportunities and challenges each day, engineering programs should be training their students to become broad based professionals, who are aware of the actual needs, values and behaviors of the people that use their solutions in their everyday life, work or play. This paper argues that in order to built such an awareness, engineering students should acquire direct, first-hand experiences of real people in real contexts. It presents a number of techniques that can be used to gain such experiences. Each technique is briefly described and illustrated with examples from our Industrial Design Engineering program. Knowledge, skills and attitude that are acquired through the use of the techniques are listed and reflected upon. Finally, our experiences with implementing the techniques into our program are discussed in view of their relevance for other engineering programs.

Keywords— industrial design; user centered design; generative techniques

SUMMARY

Traditionally, engineering schools have been concentrated on instructing students in a certain technical discipline, teaching primarily knowledge, skills and attitude specifically relevant for that field. Technical, domain-specific knowledge has been mainly transferred in classroom settings, directly from professor to student, while skills used to manipulate this knowledge have been trained in laboratory exercises and case studies. However, recent developments such as the explosion of information resources, the social responsibility of new technologies, the blurring boundaries between disciplines and the ever increasing need for sustainable solutions, all would call for the education of a new kind of engineer. One of the key qualities of these engineers would be a profound awareness of the actual needs, values and behaviors of the people that use their solutions in everyday life, work or play. This paper argues that in order to built such an awareness, engineering programs should stimulate their students to acquire direct, first-hand experiences of real people in real contexts.

The paper describes our experiences of bringing the everyday life of people into a design engineering curriculum. In several courses and on several occasions throughout our program, students are acquired to directly interact with end us-

ers, going beyond the traditional focus on product functionalities and characteristics. All techniques used for this have their base in ethnography, which is the branch of anthropology that deals with the scientific description of specific human cultures. A core principle of an ethnographic study is that data is collected through direct, first-hand experiences of daily life. In recent years this principle has been adopted in the development of several techniques that should support designers and engineers in acquiring such experiences. Three of those techniques are presented and discussed: interviews /contextual inquiry, observations and generative sessions.

Central in all three techniques is that they require students to leave the comfort zone of the classroom and take their presumptions, beliefs and ideas out into the real world. Through this they gain access to a rich and valuable body of *experiential knowledge*, which they could not have acquired in the classroom, from textbooks or from websites. Furthermore, the specific nature of the techniques, with their emphasis on direct, first-hand experiences, on active collaboration and on visual, design-directed communication, also comes with a *specific set of skills* that is desired to successfully apply them. Finally, we have noticed that the direct confrontation with real life situations and the interactions with ordinary people, stimulates students to reflect on their *personal attitude* towards people, problems as well as their own role as designers and engineers.

While our program might be much more design-oriented and human-centered than traditional engineering programs, such as mechanical or electrical engineering, it is strongly believed that these techniques could be of value to more traditional engineering disciplines as well. Although contact with the actual end-user might not be so obvious for all engineering disciplines, due to the increased multidisciplinary character of design projects all kinds of engineers have to communicate across different disciplines, and thus have contact with either internal or external users. The techniques presented and discussed in this paper, with some modifications here and there to make them better suited for a specific discipline, could be used as a framework for exploring and investigating the everyday life of these users. Thus it is our strong belief that these techniques and the knowledge, skills and attitude that they bring with them, could be of considerable value to any engineering program.

Use of E-Learning functionalities: results of a survey along Spain

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Abstract— This paper shows the results of a survey performed in Spain about the different functionalities of e-learning platforms. This survey was filled in by a group of teachers experts in Engineering Education along all Spain, through the Spanish Chapter of the IEEE Education Society. The paper shows the opinion on several aspects about the e-learning functionalities, such as knowledge level, usage level, usefulness, etc., as well as the most used platforms. One of the objectives of this work is to create a reflexive debate in the international community about the e-Learning platform use.

Keywords- e-learning platforms, e-learning functionalities

SUMMARY

During the last years E-Learning platforms (Learning Management Systems, moodle, dotLRN, Claroline, Blackboard, Web-CT, etc.) has been a new component in Learning Systems that has increase their use in Higher Education (as well as in small, middle and large companies) and proliferate in number in the learning applications scenario. The Engineering Education has been aware of this tendency and their application in on-line, distance and traditional university education.

An e-learning platform is a software application installed in a web server, which is used to administer, distribute, and supervise the educational activities of an organization or institution. Its main functions are to manage users, resources, and educational materials and activities, to control the access, to supervise the learning process and progress, to make evaluations, etc.

This year 2009, a survey [1] about different aspects on the use of e-learning platforms in the Engineering Education was filled out by the CESEI (acronym in Spanish of the IEEE-ES-Spanish Chapter) group [2]. This group is promoted by the IEEE-ES Spanish Chapter [3] and currently is composed by more than a hundred teachers of 40 universities along Spain, all of them deeply related with the Engineering Education.

This paper will show the most used e-learning platforms in Spain, the main functionalities of e-learning platforms, and the results of a survey about several aspects on these main

TABLE I
KNOWLEDGE LEVEL

FUNCTIONALITY	SCORE		
	0-4	4-7	7-10
File(Content) Download			9.2
e-mail			8.8
Tasks-Exercises			8.4
Forums			7.7
Mailing lists			7.4
Exams			7.2
Self-assessment			7.1
Surveys		6.7	
Groupwork		6.3	
Chat		6.2	
Calendar		6.1	
FAQs		6.0	
Wikis		5.8	
Blogs		5.8	
Glossaries		5.5	
Videoconference		5.1	
Notebook		4.4	
Whiteboard		4.2	
Learning Paths	4.0		
Student Portfolio	4.0		
Podcast	3.4		
Student Tracking	2.9		
Vodcast	2.8		

0 is the lowest and 10 is the highest

0-4: greater than 0 and less or equal to 4

4-7: greater than 4 and less or equal to 7

7-10: greater than 7 and less or equal to 10

ii)

is,

and (vi) Preparation Effort.

As an example, we can see in Table I the selected main functionalities and the Knowledge Level (i) on them.

Finally, the paper will end with some conclusions and reflections about the results, and the future actions that could be made.

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Active Learning in Power Electronics

From classroom to laboratory

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Abstract— Changing the paradigm from lecture teaching to student learning an experience has been carried out in a 3rd course in the degree: there will not be lecture sessions or lab sessions any more. Students go directly to laboratory and the sessions take place on guided experiments about each analyzed topology in the syllabus. So theoretical analysis, modeling and simulation and experimental results of power electronics topologies are carried out together by students. A professional power systems simulation tool with limited license is offered to each student in order to support this methodology.

Keywords- laboratory, methodology, Power Electronics.

SUMMARY

The University of Cordoba (UCO) and its Higher Technical College (HTC) have carried out many experiences with the aim of adapting teaching methodologies, guides and subject programs to the European Higher Education Area (EHEA), and more specifically, to the European Credit Transfer System (ECTS).

This has been possible by means of several Teaching Innovation and Improvement Projects Programs that supported financially the purchase of the needed materials and equipments for the adaptation. Once financial problems have been solved, methodologies and teaching paradigm have to be revised and updated to self learning procedures and experience based learning.

This experience has been carried out in a noncompulsory subject in the 3rd (currently the last) course in the degree of Industrial Technical Engineering, specialty in Electricity. Traditional methodology of lecture sessions and laboratory or simulation sessions has been suppressed and they have been joined in a holistic learning process.

Students work in a laboratory facility in which lab places are distributed likewise a lecture room. Each place in the lab is equipped with a desktop PC connected to the Internet, adequate electronic instrumentation, 3-phase 24/42/230/400 Vrms and DC supplies and a set of power converters adapted to educational purposes. A lab overview can be seen at Figure 1.

Theoretical principles are at students disposal by means of the e-learning platform UCOMoodle®. Links to java applet simulations, data sheets of electronic devices, slides, presentations, etc. are also offered in all studied cases.



Figure 1. Laboratory overview

Powersys Ltd. and the University of Cordoba have a partnership contract since 2005. As a consequence an unlimited number of student licenses of PSIM® software. So, all the students are provided with a professional simulation tool in order to prepare the sessions, check the results of analyses or prepare for solving non guided cases at their convenience. Even this simulation tool is able to be used in many other engineering subjects in the degree.

The exam consists in a summary of the labs exercises done and a more complex analysis case than included in the syllabus. Students have to expose their work and answer any question asked by the teacher or their classmates.

Students have welcomed this experience and their marks have significantly improved. Absenteeism is negligible.

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Learning engineering by teaching engineering in the European Higher Education Area.

Video engineering approach.

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Abstract— Even though active learning is not a new trend in engineering education, different schemes based in “learning by doing” are being proposed every day in the engineering education community. Considering “teaching” a topic to be a learning activity it can provide profound learning outcomes. A course previously adapted into an active learning environment has been reshaped to let the teaching experience to take place as a learning situation.

Keywords—active learning, learning by teaching, engineering education.

SUMMARY (HEADING 1)

Even though active learning is not a new trend in engineering education, different schemes based in “learning by doing” are being proposed every day in the engineering education community. There is no doubt about the benefits of “doing” as an effective learning tool applied to engineering training. Nevertheless, by itself, doing can not ensure effective learning to take place. A further reflection of what and why has been done is compulsory to transform the information into knowledge. In fact, there are several “doing situations” in which learning appear to be more exhaustive. Making students play teacher’s role (peer-teaching and peer-assessing) will let them into a favorable and very effective learning opportunity for both trainer and trainee. With these principles in mind, a course previously adapted into an active learning environment has been reshaped to let the teaching experience take place as a learning situation. Course activities try to persuade that some of the students will act, at certain moments, as trainers of a group of colleagues being trainees. Roles will change at different activity stages so that all students will have to be the trainer sometime.

The course is structured into an active learning scheme. Nevertheless, if students’ degree of motivation is not high enough it is not easy to maintain the required working level to success in the course. An interesting strategy to let students reach a high level of motivation can be found in the “ripples model” presented in [1]. Teaching a new subject is, among

others, an experience in which all ripples are present, so it can be assumed to be a true learning situation.

The learning situations generated in the course include, among others, the following type of activities:

A. Course goals statement

The first designed activity of the course is performed to let students to state course goals. If students are working what and how they want to, motivation is guaranteed.

B. Explaining contents

Group working activities lead easily to explaining-related situations. Taking into account some basic rules of cooperative learning will ensure that, at specific moments, all group members will have to act as teachers explaining their group-mates part of the course contents.

C. Tutorizing laboratory work

Some students act as tutors of any station at the laboratory. Each group has had extra time at the beginning of the semester to become experts of one of the available working stations.

D. Assessing

Possibly, the activity demanding a higher level of responsibility is the assessment. Having to assess some other’s work implies a profound knowing of the matter and a serious stage of the “learning by feedback” and “making sense” ripples presented earlier in this section. Students will have to perform peer and self assessment activities at different course stages.

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Session: 08C Area 2: Design Experiences - Subject methodologies in design

Design of an Introductory Networking subject in advance of the European Higher Education Area: Challenges, experiences and open issues

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Integrating People and Technology By Design: Design-First Instruction for Introductory Students in Information Technology

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Integrating the Design Thinking into the UCD's methodology

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Toy Design Experience: Improving Student's Motivation and Results in a Final Year Subject

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Design of an Introductory Networking subject in advance of the European Higher Education Area: Challenges, experiences and open issues

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I. INTRODUCTION

Computer Networks are constantly evolving, what changes the technical, social and economical aspects affecting the design and contents of University courses. In this paper, we will study the main changes suffered during the last 10 years and how they affect courses design. We have considered such course design in the framework of the Bologna process shift, to provide for a smooth transition once a “grade” course has to be implemented. We describe the course design and how some of our lab courses aim to teach the most interesting and applicable capabilities of networking devices using friendly exercises.

II. REVOLUTION IN EDUCATION ON COMPUTER NETWORKS

We identify next the three main aspects that, in our opinion, have suffered a significant evolution during the last ten years, conditioning the teaching of Computer Networks.

A. Ubiquity of Computer Networks – Social aspects

Nowadays, thanks to the globalization of Internet as a communication channel, students are familiar with both network-based applications and network management. In the first case, specifically, they are also familiar with the problems of multimedia applications, such as VoIP, videoconference systems, or real-time gaming, which require special QoS capabilities from the network and suffer when multiple applications make use of the network. In the second case, most of our students have already deployed and configured a local-area network at their homes. Then, we find that students are familiar with both the capabilities and problems of computer networks and the deployment and management of LANs.

B. Evolution of Networking Equipment – Technical aspects

While ten years ago contention-based Fast-Ethernet hardware was the norm, nowadays students are used to low-cost switched gigabit networks and flexible wireless accesses. Mid-range products support virtual-LANs, simplified management by web interfaces (apart from the old command-stile configuration) and prioritization of traffic of different applications. This makes the devices more flexible, simpler to be managed and capable of providing higher quality

guarantees. If not already, these capabilities will become the norm in a near future in the field of Computer Networking.

C. Networking Equipment Cost – Economic aspects

The cost of the lab equipment can condition the exercises that can be made by the students, and therefore, their learning process. However, in our field networking devices have suffered a significant drop in their cost. This allows for flexible mid-range devices to be acquired with a limited budget. In our case, we acquired five switches 3Com Baseline 2916-SFP with optical transmitter modules for less than 5,000€.

III. THE CHANGES IN THE BOLOGNA PROCESS

The current course is currently given in the Spanish “Superior Engineering”, equivalent to a Bachelor + Master (a 5-years degree including specialization). However, the Bologna process aims to provide a uniform framework across Europe, similar to the American style, with 3 or 4-years generic “grades” and 1 or 2-years specific “masters”.

When designing the subject, we considered that, while the course is still part of a “Superior Engineering” degree, we should focus on the *applied* aspects of the subject, especially considering the changes listed in Section II. Therefore, we insisted on the useful aspects (such as configuring network devices, QoS or VLANs) and gave less importance to other aspects that have been outdated by the technology (such as CSMA/CD in contention-based Ethernet networks) or are too specific (such as network dimensioning, which is left for further subjects). Such design aims to simplify the transition to a grade subject, less specific.

IV. COURSE DESIGN

In this section we will detail how we have selected and organized the contents of our course, considering the issues presented in Section II. We will argue which contents are given in the theoretical lectures and which ones are selected for lab exercises. Specifically, we will detail some advanced lab exercises that show how we exploit some of the switches capabilities: VLAN deployment and a videoconference system with QoS guarantees.

Integrating People and Technology *By Design*

Design-First Instruction for Introductory Students in Information Technology

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Abstract—We describe development and evaluation of a design-based course for introductory students in an interdisciplinary information technology education program.

Keywords—*design-based learning, interdisciplinary education, team projects*

I. INTRODUCTION

The information explosion in society has prompted the emergence of interdisciplinary programs aimed at producing the next generation of information technology (IT) professionals [2]. While such programs vary according to strengths and resources of specific schools, they share a commitment to *integrative* views of IT, namely that software should be constructed in light of complementary tradeoffs posed by technology, the human and social context, and the increasing availability and access to rich information repositories and services.

In our interdisciplinary program, a recurring challenge has been the design of a satisfactory introductory course. The requirements are many: the course should engage new students who are considering but not fully committed to IT careers; it should be accessible to individuals with a wide range of background knowledge and skills; it should preview the strengths and opportunities offered by more advanced study; it should introduce essential skills and concepts needed in future courses. Above all, it should reinforce a need for – and value of – adopting an *integrative* view of people, information and technology. In this paper we describe how we have incorporated design activities as a unifying theme in this first course.

II. DESIGN AS AN AUTHENTIC INTEGRATING ACTIVITY

Design can serve as a powerful integrating activity for students being introduced to the subtle and complex interacting influences of information, people, and technology in society. Through design, students can articulate, confront and resolve tradeoffs, while also experiencing the empowerment and reward that comes from creative work on authentic problems [1].

Learning by design is authentic due to the open-ended yet goal-directed process that designers follow. Design is not puzzle solving; there is never a “right” answer. But clearly design is motivated by goals that are translated into concrete specifications as the goals are understood and mapped to possible solutions. The authenticity of learning by design can be enhanced even further if it takes place in a team that brainstorms and

negotiates ideas about real world problems. A shared design process allows students to experience collaboration, tool use, domain-specific problem solving, and reflection-in-action [3].

III. COLLABORATIVE DESIGN OF IT ARTIFACTS

The learning goals of this course include an appreciation of separate but related concerns regarding information structures, humans and organizations; and technology. Thus we organized collaborative design projects organized into three phases: 1) The team identified and analyzed *information artifacts* in a team-selected domain (e.g., inventory in e-commerce); 2) Given this information analysis, they analyzed usage scenarios and concerns for *stakeholders* at multiple levels of analysis (e.g., customer, clerk, manager, store); 3) The team envisioned and prototyped a simple *technology artifact* that addressed stakeholder needs and tradeoffs (e.g., user-friendly interactive dialog for customer-clerk Q&A). The prototype was documented, shared and critiqued as an end-of-course video.

Our primary outcome measure was student reaction; project scores varied considerably with team expertise and interest, and our main concern was to orient and motivate the introductory students. Pre-post comparisons of self-efficacy ratings revealed that students believed their skills had increased, and that this was particularly true for their capacity in information analysis and technology prototyping. These outcomes were strongest for students who arrived with the *weakest* technology skills. In open-ended comments, more than 80% of the students felt that the design orientation was helpful in learning the new concepts.

IV. CONTRIBUTIONS AND FUTURE WORK

Our work makes specific and general contributions: we developed and evaluated design-based activities suitable for introductory education in interdisciplinary IT programs. More generally we have begun to evaluate how design thinking can promote an integrative approach to IT education. In future courses we will articulate more finely the role of design in understanding tradeoffs in information, people and technology.

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Integrating the Design Thinking into the UCD's methodology

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Abstract—In this paper we describe how we have integrated several techniques of the “Design thinking” (DT) into the User Center Design (UCD) methodology in the process of development of project as a learning activity. The experimental activity has been carried out with students of the Human Computer Interaction's subject, corresponding to the 3^o course of the School of Computer Science of the University of La Laguna.

Keywords: *Design Thinking, UCD, HCI, elearning*

SUMMARY

The Human Computer Interaction is a subject corresponding to the 3^o year of the Computer Science Engineering of the University of La Laguna. This subject include the contents relating with usability, accessibility, design for all and User Centered Design (UCD) methodology. Since 2004, we have been using a learning methodology based on projects and collaborative work and the blended learning model supported by Moodle. During the first course, several activities of Computer Support Collaborative Learning (CSCL) has developed [1]. Among these activities, we can highlight the creation of wikis (inter & extra groups) with a clear specification of roles and distribution of tasks. In the successive courses, this work group and based on projects' methodology has continued, changing the type of activities and experiences carried out to the laboratory. So, we have worked since the integration of multi player video games with Moodle, analyzing the motivational factors in learning process [2], to the creation of collaborative conceptual maps to support the User Centered Design (UCD) methodology. The last learning activity was carried out in the design and development of the projects selected by students.

During the 2009 we have integrated techniques from the creativity area with techniques of the design of interfaces from the Human-Computer Interaction (HCI) area. So, from the creativity area, we used the design thinking [3] as a creative process based around the "building up" of idea. However, from the HCI area, we used the UCD methodology as a design philosophy, in which needs, wants, and limitations of the end user of an interface take special attention at each stage of the design process [4,5]. Specifically, we have worked and integrated to UCD the following methods of the design thinking: a) Creative exploration (to look for quantity, ideas), b) Building and hands thinking (prototypes) and, c) Simulation and role playing (interactive situations).

The “building games” using the game thinking based on building and where the learning is a sub product of the game. In this kind of games, the ideas are explored through prototypes, both in the design and with the physical objects, allowing the experimentation in the design. In the case of the designers, this “building games” is denominated “to think with the hands” and it is achieved with “low cost and quality prototypes”. This game allows to find solutions through prototypes and to carry out the designer's thinking to the real world quickly. On the other hand, when we talk about to design something that is not a physical object but it is a system of interactions, we can use the “role playing”. The role playing is very useful to think in experiences, to put us into the situation that we are designing and to project us in this situation. We can said that through the role playing we can achieve the “empathy of the designer”, because the designer can put himself in the place of users of h” is designs and can imagine the situations where the designs will be used. It is so important in the instruction of further designers, because they must try the proposed solutions and the “role playing games” are very useful as “prototypes of situations”.

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Toy Design Experience:

Improving Students' Motivation and Results in a Final Year Subject

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Abstract— In recent years educational gaming has been progressively perceived as a very effective tool for improving teaching-learning activities in higher education. The use of such play-based methodologies for engineering education can promote several practical and communication skills of great value for students' future professional development. At the same time it greatly helps to motivate students and make them more aware of their own capabilities and the learning process.

This paper details the application of a play-based methodology for improving students' results and motivation in the subject "Development of Plastic Products". The active learning strategy consists in assigning student groups different toy development tasks, so that they can apply the design concepts learned and present their results in public. It is thereby hoped to promote a set of abilities that are ever increasingly valued in the industrial and business world, such as teamwork, creativity and communications skills.

Results have been compared with experiences from previous years, linked to the development of conventional products. The results show that carrying out a monographic experience on "Toy - Design" has promoted students' satisfaction, motivation and results. Some ideas for future improvements, mainly based on students' opinions, are also discussed.

Keywords: *Learning through play, Active learning, Motivating students, CAD-CAM-CAE Tools, Rapid Prototyping Technologies.*

I. INTRODUCTION

The subject "Design and Manufacture with Plastic Materials", taught in the 5th course at Universidad Politécnica de Madrid (UPM) as part of the Mechanical Engineering Degree, has been designed to fit in with the trends towards educational innovation and active learning set out within the framework for implementing the European Higher Education Area (E.H.E.A.) [1] following the purposes of the Bologna Process.

With this process implementation, higher education systems in European countries should be organised in such a way that:

- It should be easy to move from one country to the other (within the European Higher Education Area) for the purpose of further study or employment.

- The attractiveness of European higher education is increased so that many people from non-European countries should also come to study and/or work in Europe.
- The European Higher Education Area should provide Europe with a broad, high quality and advanced knowledge base, ensuring the further development of Europe as a stable, peaceful and tolerant community benefiting from a cutting edge European Research Area.

The active learning strategy proposed in our subject consists in assigning groups of students different product development tasks, so that they can apply the design concepts learned to real problems, and then present their results to their fellow-students. It is thereby hoped to promote a set of abilities that are ever increasingly valued in the industrial and business world, such as teamwork, creativity and communications skills (ABET Professional Skills) [2].

The tasks begin with an analysis of existing products and end with the production of prototypes. This means that the new Rapid Prototyping Technologies [3] available in the UPM's "Product Development Laboratory" can be applied for teaching purposes, thereby implementing a teaching-learning method that at all times promotes active student participation.

The most important educational innovation objectives of this experience are:

- To enable students to experience a complete product development, from the conceptual design stage up to carrying out tests on a physical prototype.
- To follow the stages really used in industry, when it comes to designing and manufacturing new products.
- To encourage students to participate actively in their own learning process.
- To emphasise the importance of teamwork and finding solutions reached together.
- To continually induce students the use of critical thinking as essential tool for solving problems.

Session: 08D Area 3: General Issues in Engineering Education - Innovative Experiences

The developing of personal and professional skills in automotive engineers through university competitions

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MotionLab

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Reflections about Teaching Engineering Graphics: Knowledge and Competencies Management

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Measuring collaboration and creativity skills through rubrics

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The developing of personal and professional skills in automotive engineers through university competitions

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Abstract—This electronic document is a “live” template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document. (Abstract)

Keywords—component, automotive engineering, skills, competition, SAE Formula

Universities are ever more concerned to open up students’ training perspectives towards aspects that are not always a part of their studies, such as enhancing their personal and professional skills. Thus, for several years, the experiences of educational programmes have been regularly published where the enhancement of theoretical-practical knowledge is only one of the goals sought.

In a simplified way, what is understood by skills is “a combination of knowledge, abilities and attitudes that are suited to particular circumstances”. De Miguel et al offer a fuller definition when they say, “by skills is understood the set of knowledge, abilities, behaviour and attitudes that favour work being done properly and which the organisation is interested in developing or recognising in its co-workers when it comes to achieving the company’s strategic goals”.

So, a genuine promotion of personal and professional skills has not been a generally sought after goal, since trying to make students change their behaviour and attitudes involves using other teaching methods that are usually more costly regarding time, space and personal resources, although on occasions, these methods simply need to be more imaginative.

Years before people became fully aware of the importance of promoting personal and professional skills in the university sphere, companies in different sectors recognised the gap existing between university and business, and on some occasions proposed activities to try and narrow it.

For instance, in 1982 engineers from Ford, DaimlerChrysler and General Motors, grouped together in the SAE (Society of Automotive Engineers), in the United States, being aware of how little newly graduated engineers were adapted to automotive companies, designed a competition for universities throughout the world, which involved conceiving, designing, manufacturing and competing with a single seat formula-type vehicle. This competition was called the SAE Formula.

They were of the opinion that this kind of challenges would serve to accelerate engineering students’ professional profiles, forcing them to work as part of a team, with high levels of communication, responsibility and motivation, forcing them to use in their work a large part of the knowledge acquired in their degree.

The UPM is taking part in this competition since 2004 in England (where it’s called Formula Student). From the beginning, the project has been based on four principles that are a statement of the teaching method used:

- Learn by applying
- Learn by doing
- Learn in a team
- Learn by competing

The relationship between the UPM and the Institut Supérieur de l’Automobile et des Transports (ISAT) of Nevers (France), whose students take part in some automobile competition since several years, lead both institutions to share their experience and to plan a whole strategy of learning situations through which participants must pass through during their period in the teams, in order to maximise their performance and progress.

In this paper the authors, teachers from UPM and ISAT, present the basic features of the SAE Formula project and some other international competition such as Eco-Shell Marathon, Formula Baja or Formula Low-Cost, and analyze the way these competitions helps to promote 24 basic skills in the students, compared to other activities carried out during their engineering degree courses.

MotionLab

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Abstract— MotionLab is an experimental system for the study of physical motion created as a learning objective of the Industrial Engineering students. MotionLab uses the accelerometers and the infrared camera of a game controller as a data acquisition interface present in the consumer electronics market. The aim of this system is to monitor and to study the results of physical experiments about solids motion under different conditions. This research line, aimed primarily at education, tries to build low-cost experimentation systems replacing the classic ones, which result, mostly, as less efficient and need more expensive laboratories.

Keywords—Laboratory experiences; remote laboratories; accelerometer; low cost; motion; sensor; physical experiments.

SUMMARY

Currently, consumer electronics offers better performance features every day, thanks to its large-scale manufacturing, which has produced a decrease in costs. Two of the technology sectors in which faster evolutions have been made are the telecommunications and entertainment sectors in which new products incorporate advanced technologies that traditionally had a high cost.

For engineering students, laboratory and practices constitute a fundamental step in the learning process. Indeed, laboratory experiments help them to improve the understanding of concepts and skills, to familiarize with the use and management of measuring equipment and to develop specific skills required for future work. For these reasons, the most important institutions, which deal with scientific-technological training, try to dedicate a large budget to equipment and maintenance practices' laboratories. However, the evolution of technology quickly results in these equipments becoming obsolete and needing replacement, consequently increasing the investment in this educational activity.

In this case, this research line [1] is focused on the reuse of low-cost devices used in the new generation of video consoles, which incorporate technologically advanced control devices. These controls contain different types of sensors such as accelerometers, infrared cameras, gyroscopes, etc. The reuse of these devices has allowed the construction of MotionLab, a high precision experimental system oriented to the study of physical experiments, such as motion experiments.

Consumer electronic devices, that incorporate accelerometers, which can be used for different applications of those they were originally conceived, as it is the case of the Wii remote controller (called Wiimote) connected to other devices with greater capacity to process such as a PC, can be found in the market. In the educational field there are other researches using this remote controller like [2].

The study of physical motion, such as kinetic motion, is essential for engineering students. Students begin to explore concepts such as velocity and acceleration. For a correct understanding, in addition to the theoretical knowledge of these concepts, experimental study is essential for their comprehension as well as practical experimentation. One of the best ways to study acceleration and its effects is using accelerometers to accurately show the characteristics of a concrete experiment. In this laboratory it is shown that isn't necessary to use high accuracy sensors, and therefore high cost, but low-cost sensors that can perform these experiments and that allow to students acquire a high grade of assimilation of the theory.

The main objective and the origin of this system was to obtain a low-cost universal platform for studying the motion of solids in different conditions. As mentioned, MotionLab is a system for the study of kinetic experiments that allows the study of solids motion in different conditions (collisions, pendulum-like motion, etc.). As a fundamental element, the system uses the Wii remote control device (manufactured by Nintendo and available on the Wii console) and the built-in sensors. It is a flexible and scalable system that enables rapid incorporation of new types of experiments.

A web application complements MotionLab which allows students to share and to store the results of the experiments. It also allows teachers or administrators to manage the system.

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Reflections about Teaching Engineering Graphics: Knowledge and Competencies Management

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Abstract— This article contains some reflections about the experience of the authors after a decade teaching assignments within Engineering Graphics area, like Graphical Expression, Computer-Aided Design, Industrial Drawing, Descriptive Geometry and Technical Drawing, and others related to several Master Programs as Master in Graphical Design. Reflections consider advantages and disadvantages of those traditional experiences regarding to graphical aspects, such as the magisterial Class, practical classes in small groups or working out different tasks and how all of this affects the final results, considering students opinion.

On the other hand of this traditional system is another one based on the learning directed to those students who have ECTS credits, inside the European Educational Higher Space (EEHS) and the experiences in several Universities before entering 2010-2011 season. Knowledge and competencies management are considered within this new system and they be included in the Teacher Guide so that those students who approve the subject acquires specific competences (subject specific knowledge). These competencies coordinated with those specific obligates teachers to develop particular activities, because the detailed knowledge of each is a main condition in order to program competencies briefings with a high detail level. This is not an easy task considering the experiences and opinions of famous professionals specialized in competences issues.

Therefore, new activities should be set up and include new Information and Communication Technologies, such as Internet, search of information, E-learning educational platforms, and a different orientation for individual and group follow up and for seminars and classes in the University environment as well. Sometimes, practical orientation of the lesson should focuses on real cases, on the solution of a real problem. This is more complicated in lessons during the first year when there is a lack of knowledge of other subjects considering that a lesson is not a knowledge “island” in a “sea” of subjects. Nevertheless, besides the difficulties those teachers who have not got that specific training have it becomes a closer challenge and a push to enter the EEHS with a renewed motivation and a different vision about new activities that should be develop.

Keywords- *Engineering education; Engineering drawings*

Measuring collaboration and creativity skills through rubrics

Experience from UTPL Collaborative Social Networks Course

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Abstract—In this paper, we introduce several rubrics to measure a set of collaborative and creativity grading. Rubrics are powerful tools for both teaching - learning and assessment. Rubrics improve communication between teachers and students. This work relates the general criteria to measure the complexity levels in the development of creativity and collaborative work competences with concrete indicators associated with the use of Social Web tools and concepts. These indicators have been used in the assessment of competences in a particular course related with the use of collaborative networks.

Keywords—component, Rubrics, Social Software, Assessment

SUMMARY ONE PAGE SUMMARY.

Rubric assessment of competences and skills results in a number of benefits to students and teachers in Universities.

Engineer employers affirm that some competences in certain non-technical areas such as communication ability, economics, leadership, teamwork or creativity are not practically being considered in their formation. Accreditation Boards, Engineering Associations, are also demanding the incorporation of the called generic or transferable competences for the actual and the future engineering degrees. Generic competences constitute the basis for the ability to develop discipline-specific competences. At present, faculty and staff are developing and articulating these important linkages to create strong curricula plans. Firstly, it is needed to define competency mapping as the process of identifying key competences for a particular degree. This process involves supporting and enabling staff to fully reflect upon potential competences, conducting formal research to identify the most important competences, and reaching consensus. Finally, this approach supposed important changes in the current teaching-learning processes of many Institutions.

Key competences should be acquired by pass from a hierarchic model (where teachers are considered as knowledge dispensers), descendent and focused on the teachers toward a collaborative model/horizontal where the student is in the centre of the model and teachers fulfill their role of guides in the teaching - learning process. These key competences are all interdependent, and the uses of social web tools are potential

facilitators of that change, especially with the creativity and collaborative work competences.

Creativity is considered as the ability to provide novel answers to a proposal or problem given, or to discover new relations and give them new mental structures, respectively. Rubrics are evaluation instruments that can be applied to assess these competences. But they require the identification of new indicators that can be directly assessed.

This work relates the general criteria to measure the complexity levels in the development of this competence with concrete indicators associated with the use of Social Web tools and concepts. These indicators have been used in the assessment of competences in a particular course related with the use of collaborative networks.

Rubrics allow students to understand the expectations of their instructors. They provide direct feedback to students about what they have learned and what they have yet to learn. Second, students can use rubrics for self-evaluation. Finally, rubrics emphasize “understanding rather than memorization, ‘deep’ learning rather than ‘surface’ learning”.

Teachers also can benefit from rubric assessment in two important ways. First, the rubric creation process provides an opportunity to discuss and determine agreed upon values of student learning. Rubrics “make public key criteria that students can use in developing, revising, and judging their own work”. Second, rubric assessment offers university manager and faculty assessment data full of rich description that can be used to document how to improve courses. The purpose of use Web 2.0 in education is considerer the benefits from the collective intelligence, the positive effects of networks, and collaborative tasks through Internet.

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Session: 09A Area 1: Uses of Technology in the Classroom - Learning Experiences

Challenges in an Emerging Country: A Digital Divide Case Using Robotics

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Team Teaching for Web Enhanced Control Systems Education of Undergraduate Students

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Enhancing Learning Systems by using Virtual Interactive Classrooms and Web-based Collaborative Work

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How can Apache help to teach and learn automatic control?

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Challenges in an Emerging Country: A Digital Divide Case Using Robotics

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Abstract— This digital divide case is sponsored by UNESCO and Brazilian Education Ministry as a pilot-project science and technology democratization initiative named RoboEdu. The main role is to allow that high school students can be the first technologies contacts using computers and robotics experiments due them low profile families remuneration. The initiative uses education interactions as main engine to guarantee the math and physics studies understanding and to reach the best cognitives practices approaching to the ideal pedagogic model. The teacher needs technical support also cause the language used must be translate to a simple vocabulary where students achieve the learning goals. The educator essential role starts to be several possibilities of knowledge generation not mattering anymore who knows technologies but through the part of the involved ones into orientation, participation and exchange of experiences. When the teachers and students are engaged on these activities pertaining to school evasion is reduced drastically

Keywords-component: *digital divide; robotics; technologies; educational learning*

I. INTRODUCTION

This article describes the development of the activities under the RoboEdu project, which allows students from the public network to have their first contact with computers and robots, interacting during classes of Math and Physics, that deal with subjects from the practical experiments, in a more curious and questioning manner formatter will need to create these components, incorporating the applicable criteria that follow.

The use of tools that allow the improvement of the topics addressed by the educators is a key factor on the quality of learning at the schools. Educational, or Pedagogic, Robotics, is a strategy of exposure of the knowledge and takes the practice of the individual, by fixing issues by assembling and adapting equipments and models that shall present moves, such as robots.

This learning environment is characterized by the use of robotic systems, which allow students to build systems composed by a physical part (hardware), that constitutes the robot's structure, and programs (software) that sets the interaction of the knowledge acquired at the classroom and their behavior.

In this context, suggestions of unconventional learning present themselves for students and teachers of the public institutions, from practice to theory and from theory to practice, showing gaps of knowledge not explored until then, and, moreover, it allows these students that, many times, are poor, both socially and economically, the contact with state of the art technology, that ends up allowing curiosity and knowledge to act as stimulants.

II. JUSTIFICATION

In this pilot project, the learning stimulus focus on the involvement of the students in the activities related to studies performed in the classroom, applied through the simulation of throws in a basketball game, using the KickRobot software, and handling and controlling of robots physically composed, before their pairs or classmates, generating, this way, a more effective participation of the involved with a focus on the best work resulting of a team performance.

According to Resnick, when a person is committed into building something that is significant to the person itself, or to the people around, the building of knowledge happens in a more effective way. When the student is involved in building and modeling robots, this student starts to have a greater sense of care in the relation with this object, different than it would be if the student had received the robot already assembled. In this manner, the students are prone to explore and make deep connections with scientific concepts based on the activities performed [1].

Team Teaching for Web Enhanced Control Systems Education of Undergraduate Students

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Abstract— The present work focuses on the didactic approach for the HE in technical-scientific domains, namely Control Systems undergraduate courses, via blended e-learning. Material knowledge has to be learnt. So, tools to be integrated in Moodle to manage related didactic variables have been developed, such as an Immersive Telelaboratory. In such a context a team approach to teaching was adopted. It seems useful to summarize such experience putting into evidence its potential and some critical aspects related to the implementation of the approach.

Team Teaching, Material Knowledge, Immersive Telelaboratory, e-Learning

I. INTRODUCTION

Engineering designer education involves to master complex physical phenomena, and the analysis of complex systems in several application domains. The focus should be on acquiring the competencies and abilities of an expert designer. One among them is “Material Knowledge” (MK) [1], whose main features are: the owners are experts; it is compiled and implicit, and can be described as intuitive; it is empirical. To try to teach MK asks for active, experiential and collaborative learning. F2F, with a few students, laboratory activities are practiced; with many students we use Immersive Telelaboratories (IT) accessible by the net. Immersivity is specified as follows: remote users experience the presence into the real environment – a laboratory – by means of a rich perceptive Internet-based bi-directional interaction comprehending vision, hearing, perception of current modification of physical quantities [2]. A undergraduate Control Systems course has been given following a Team Teaching approach (TTa). TTa [3] involves a team of teachers, each devoted to different tasks, usually in synchronous/asynchronous blended learning. In our case has been used in a F2F/online blended modality.

II. THE POTENTIAL OF TEAM TEACHING IN THE CASE OF LARGE INSTITUTIONAL CLASSES

We refer to an undergraduate course of Automatic Control, compulsory for an Information Engineering curriculum, having many students (around 300), delivered in blended e-Learning. Blended means a suitable mix of F2F lectures/numerical cases study presentation and on-line activities with and without tutoring. Many on-line activities is asynchronous, students' self-learning and self-evaluation. Some laboratory experience is deemed very useful. To overcome the organization, structure and cost involved in of providing laboratory facilities for a very

large number of students, an IT has been implemented and integrated within the UNIVPM Moodle LE. Course and courseware design, implementation and delivery followed a three-teacher model [4]. The responsible of the whole course has the coordination and most directive activities, numerical case studies are in charge of another domain expert, a technology expert gives on-line support for the LE use and IT access administration. The architecture of the whole LE is described in [2]. Collaborative learning is promoted by inviting the students to self organize in small Groups, to carry out some experiment into the remote laboratory, to reflect together in a specific tutored forum and to produce an essay collecting their reflections on the experiments, without synchronous tutoring..

III. STRENGTHS AND WEAKNESSES OF THE EXPERIENCE

Strengths are mainly:- improvement of teaching/learning effectiveness; -openness to innovative teaching strategies. Wrt IT, maintenance and supervision of the physical devices into the lab and level of students' awareness of the MK involved in its proper use are critical issues. The MK owner is in reality a fourth teacher, usually involved in laboratory management. Therefore, the TTa should be extended to a four teachers team. Such an extension would make dramatic the teachers time management problem. When it finds a satisfactory solution the quality of learning is significantly improved. Moreover it appears that the use of synchronous on line tutor-students interaction could greatly improve student awareness of MK.

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Enhancing Learning Systems by using Virtual Interactive Classrooms and Web-based Collaborative Work

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Abstract— There are many e-learning web sites and e-learning systems that are available with excellent content and design but they generally lack interactive response and face-to-face communication. Students cannot ask questions and get responses immediately. It is similar to one way communication for learning. However, learning is most effective when it actively constructs knowledge during group social interaction and collaboration. Therefore, this paper proposes to inspire creativity in e-learning called the virtual interactive classroom by using RTMP (Real-Time Messaging Protocol) which is a sophisticated TCP-based real-time networking protocol which supports the efficient exchange of messages, synchronized data, audio, and video. Teachers and students can publish streaming audio, video and other data messages to present streaming media with interaction or navigation. Using this virtual classroom on the internet, students can immediately interact with teachers as though they were studying in a real classroom. In addition to the virtual interactive classroom, this article also proposes using web-based collaborative work as an add-on feature to the learning system. Both teacher and student can use web-based collaborative work for sharing resources and exchanging ideas after the class. The integration of the two concepts of the virtual interactive classroom and web-based collaborative work in order to enhance teaching and learning performance has been created.

Keywords-component; formatting; style; styling; insert (key words)

SUMMARY

This article presents the potential of integrating two concepts, namely those of a virtual interactive classroom and a web-based collaborative work application in order to enhance teaching and learning performance in distance learning. In addition to the concepts, the framework has been designed and implemented. The virtual interactive classrooms and the web-based collaborative work application work well according to their predefined functions. They can work as a substitute for any classroom in the school. Using this virtual classroom on the internet, students can immediately interact with teachers as though they were studying in a real classroom. Teachers and students can publish streaming audio, video and other data messages to present streaming media with interaction or navigation. With the use of computers and information technologies, the barriers of space and time can be eliminated. This virtual interactive classroom is an opportunity for a number of students in rural areas with homes that are far away from a school. They have a chance to study and communicate with the teacher and other students. We do not mean to imply that by using this virtual interactive classroom on the internet that it is better than the real classroom in the school but it is a choice in order to move schools closer to students who lack of the opportunity of physically attending a school. We want the virtual interactive classrooms on the internet to be one standard feature of several possible features for e-learning or distance learning.

How Can Apache Help to Teach And Learn Automatic Control?

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Abstract—Looking for the right examples to motivate students and ease their path to reach knowledge in a subject is really important. Future Computer Science and Telecommunications Engineers tend to think that Automatic Control is not important for them. But, if we blend examples from two areas: telecommunications and control, maybe we can change their minds. These engineers work with web servers: systems that deal with a lot of requests and must give fast responses to users. Important variables such as CPU and memory could improve their performance if automatic control techniques are applied. Apache is one of the most well known web servers and is at this point where Apache can help us

Web Server; Apache; Automatic Control; Internet server; PID; predictive control

SUMMARY

Automatic control blends mathematics and engineering so real systems can be controlled. For example, we can apply control techniques to ensure that a reactor does not reach a critical point, or we can control an airplane velocity or altitude. Future Computer Science and Telecommunications Engineers (in Spain) learn about Communications Networks and Internet and they also learn automatic control techniques. It is sometimes a difficult task to find systems that appeal to them from both sides: communications and control. Most control books present electrical or mechanical examples. Only in [1] have we found a textbook following a computing vision.

Apache ([2]) is a web server developed and maintained by the contributors to the Apache Software Foundation. There are variables that are critical for the right performance. As presented in [3], we can apply automatic control techniques to achieve better server performance. It should be decided which variables will act as inputs or manipulated variables and which variables will be the outputs or controlled variables. The work in [3] is used as reference. We aimed to design a tool that could be used in the classroom and act as a pool of control techniques to experiment and compare results.

CONAPA (CONtrolling AP Ache) is the user's tool. The application is user friendly and can be used to monitor the real system's evolution or to actively control the Apache web server. It works both as an online and as a virtual laboratory. Data can be saved and loaded in different programs to analyze results. This application manages the data capture for

identification purposes, the simulation environment and the control of the real system.

The working environment consists of a server running the modified Apache connected through a 100 Mbps LAN to a machine running a synthetic workload generator (Curl-Loader, [4]). Both machines run under Ubuntu (www.ubuntu.com). The application has been developed using the LAMP (Linux, Apache, MySQL and PHP) architecture ([5]).

The output or controlled variables are the CPU and the memory of the server. The input variables are Apache's KeepAliveTimeout (KA, [2]: number of seconds the server will wait for a subsequent request before closing a connection) and the maximum number of clients (MaxClients, MCF or short) that can connect to the Apache server.

MC and KA cannot be modified in the standard Apache. As we needed to change their value dynamically, the Apache source code was modified. The paper gives details on how to do it.

Using CONAPA, students can apply different control techniques to the system. Such as PIDs ([6]) and predictive control (GPC, [7]).

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Session: 09B Area 4: Active Learning - Collaborative learning

Retaining and Retraining: An Innovative Approach to Educating Engineers in a Changing Economy

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Active Learning in Telecommunication Engineering: A case study

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Reviews and Findings on Implementing Active Learning in a Large Class Environment

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Cooperative Learning vs. Project Based Learning: a practical case

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Retaining and Retraining:

An Innovative Approach to Educating Engineers in a Changing Economy

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Abstract— Changing economic and technological conditions require that talented and experienced engineers adapt and update their engineering skills. Communities support education and retraining in order to retain the human talent. This paper describes an innovative approach to helping engineers overcome barriers to career transitions, which incorporates career and personal development, an engineering skills refresher, a semester-long course at a top-tier engineering school, and an internship at a company in a high-growth sector.

Keywords- *engineering professional development; continuing education; retraining; community development*

SUMMARY

We describe the motivation for embarking on a career re-engineering program. A large percentage of the engineering population in our community is engaged in semiconductor design and manufacturing, an industry in decline. In order to harness the collective skills and talents of engineers in the semiconductor industry and to redirect those skills, the Center for Lifelong Engineering Education provides training to help engineers to re-tool their skills for growth industries.

We describe success factors for a career re-engineering program, including (1) the engagement with multiple stakeholders: a university engineering faculty, community development organizations such as workforce commissions, companies in high-growth sectors, the university career counseling center, and governmental agencies; (2) the acquisition of funding to help support engineers as they

embark on a retraining curriculum; and (3) the application process and selection criteria.

We describe the curriculum, including an initial orientation and assessment program; the selection of appropriate and available fall-semester engineering classes in fields such as biotechnology, nanotechnology, and environmental sciences; monthly workshops designed to improve communication, presentation, adaptability, and networking skills; weekly small-team meetings designed to keep participants accountable; regular meetings with individual mentors; and a spring-semester internship with a firm in a high-growth sector.

We believe the programs to help retrain engineers and to retain engineering talent within a society are critical to community sustainability and growth. This program can be adapted to any community with a university with an engineering program. The program takes a holistic approach, including the economy, the technical skills for future engineering growth, and the people skills that engineers need.

We provide a history of the technology changes, describing how countries and companies grow and thrive when they are able to leverage an engineering innovation, and how countries and companies go into decline when they fail to adapt to changing conditions. .

The economic history provides the background and motivation for the concept of a community supported retraining program.

Active Learning in Telecommunication Engineering: A case study

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Abstract— Bologna process establishes a big change from class-based lessons to active learning. This process shifts the focus from instructor-centered teaching to student-centered active learning, putting the student in the centre of his own learning. This paper presents a case study of active learning in Telecommunication Engineering at Rey Juan Carlos University. Specifically, it presents the experience of different active learning activities in Object Oriented Programming (OOP) subject, where students developed their initiative and critical thinking. This paper presents both global data (i.e. number of students, their background, description of the theoretical, practical and new active learning activities) and specific data (i.e. scores obtained in the different activities proposed, time spent in each learning activity, participation in the learning activities, students' interactions, etc.). Furthermore, the comments of the own students about their personal experience with these new active learning activities are included.

Keywords: Engineering Education; Collaborative Work; Active Learning.

SUMMARY

Bologna process establishes a big change from class-based lessons to active learning. This process shifts the focus from instructor-centered teaching to student-centered active learning, putting the student in the centre of his own learning. This new educational paradigm requires other methodologies that enhance the active role of the student, his initiative and critical thinking. A combination of different individual and collaborative learning activities play an important role in providing new contexts in order to develop these skills.

This paper presents a case study of active learning Object Oriented Programming (OOP) subject of Telecommunication Engineering at Rey Juan Carlos University. In past years, this subject was structured in theoretical and practical sessions. In theoretical classes, the teacher explained concepts, showed examples of the concepts and proposed exercises to students. In practical sessions, students should develop Java applications in order to put in practice theoretical concepts. In this model, students were already participated of their own learning process.

This year, the teachers of this subject thought that could be useful to include learning activities where students develop their initiative and critical thinking. With this goal, they proposed some practical exercises of object oriented design in order to promote his initiative. Also they proposed a collaborative activity to develop his collaborative learning; and new practical sessions were proposed to students with the aim of fostering his critical thinking. Students adopted the teacher role both the practical design exercises and the collaborative activity. In the first one, students should do a set of design exercises individually. After doing them, they adopted the teacher role and they should check the same set of exercises or a similar set from two classmates. This step allows that students learn from the solutions of their classmates. Furthermore, they get a bigger level of knowledge, since evaluating another colleague demands a more deep knowledge of subject matter. They are aware of their own mistakes, understand multiple choices to solve the same problem, realize improvements, and so on. For performing this activity, 'Programming Assignment Correction System' was used by students. The second activity is collaborative. The teachers suggested a list of topics related to theoretical concepts explained before to students, which complement the list of topics of OOP subject. Students should organize themselves in workgroups and choose a topic. The work of each group consisted of studying the topic chosen, extracting essential information and doing a public presentation. Last new activity consisted of learning basic concepts in a practical way. The students should have read a research paper and extracting the relevant information to apply it in the resolution of problem associated with paper.

Finally, this paper presents both global data (i.e. number of students, description of the theoretical, practical and new learning activities) and specific data (i.e. scores obtained in the different activities proposed, participation in the learning activities, students' interactions, etc.). Furthermore, the paper includes the comments of the own students about their personal experience with these new active learning activities.

Reviews and Findings on Implementing Active Learning in a Large Class Environment

for Mechatronics and Computer Science students

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Abstract— This paper tackled the issues of different learning preferences for Computer Science and Mechatronics students in a large class environment by using different active learning methodologies. Apart from implementing active learning methods in the class, another idea present here is coupling with another course. The efforts required and the effectiveness for these methods are being presented, with this the suitable methods can be selected depending on the participants and the resources available.

Keywords—Computer Science education, Education, Engineering education, Mechatronics

I. ONE PAGE SUMMARY

The courses Embedded System 1 with course code FB16-6951 (ES1) and Embedded System 2 with course code FB16-6952 (ES2) were introduced in summer semester 2006 and winter semester 2006/07 respectively. Among the few challenges faced by the lecturer and the teaching assistant were:

- The students are from non-homogenous backgrounds. Among them are two major groups of students – Computer Science and Mechatronics.
- The respective class sizes were large [1]. The number of students after summer semester 2007 for ES1 is between 90 and 110 students, and ES2 are between 70 and 80 students.
- The limited teaching resources available to handle a large class.

The objectives of ES1 and ES2 are to train students to think independently as well as in a team when designing and implementing an embedded system. Both ES1 and ES2 are offered to the students in their third and the fourth semesters. These are two of the very first courses in the faculty where interdisciplinary course contents are taught to an interdisciplinary group of students.

Students tend to be able to internalize the course contents when they not merely listen in the class but are engaged during the class [2]. Bonwell and Eison [3] further discussed that

active learning means students must engage in higher-order thinking tasks such as analysis, synthesis, and evaluation.

This paper is going to introduce the different active learning methods implemented in ES1 and ES2 to encourage interaction between the students, to help the students understand the course content better, and to encourage the students to work on the course content on their own. Among the active learning methods implemented in the classes were demonstration during lecture; question and answer; coupling with software tools class, group work; pop quizzes; and feedback on each chapter of the course using “most important and muddiest part of the lecture” card. These different methods were implemented in University of Kassel across 5 semesters, from summer semester 2007 to summer semester 2009.

In order to assess the impact of the different methods implemented, whenever possible one evaluation will be conducted during mid-semester and another at the end of the semesters. The paper will generally describe and give examples on the implementations of each active learning method in the class; the feedback from the students; the assessment and the contribution of these methods

After describing the different methods implemented in the different semester, the effectiveness of the different methods with respect to the Computer Science and Mechatronics students will be discussed. The efforts required to implement the different methods will also be presented. This will help readers choose the suitable methods as per the available resources.

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Cooperative Learning vs. Project Based Learning

a practical case

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Abstract— Two different methodologies, Cooperative Learning (CL) and Project Based Learning (PBL), have been applied to different groups of an Operating Systems I course at the Universidad Politécnica de Madrid. This paper presents a comparative analysis of the academic performance and the drop-out of students, as well as the results obtained in an opinion survey asking about the effectiveness of each methodology. The results obtained point out a greater academic performance with PBL than with CL.

Collaborative work; Education; Engineering Education

SUMMARY

The Bologna Declaration and the implementation of the European Higher Education Area are promoting the use of active learning methodologies such as Cooperative Learning (CL) and Project Based Learning (PBL).

“Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning” [1]. On the other hand, PBL has been established in the field of engineering as a significant experience which promotes cognitive activities and long-life learning [2].

The fundamental hypothesis tested was whether the academic success achieved by the students of the first years of the grade was higher when CL was applied than in those cases to which PBL was applied.

A practical case, by means of which the effectiveness of CL and PBL are compared, is presented in this work. This study has been carried out at the Universidad Politécnica de Madrid, where these mechanisms have been applied to the subject Operating Systems I of the degree in Technical Engineering in Computer Systems (OSIS) and to the same subject of the degree in Technical Engineering in Computer Management (OSIM). Both subjects have the same syllabus, are taught in the

same course and semester and share also formative objectives. OSIM has been taught applying PBL to a group of 60 students, while OSIS has been taught applying CL to 107 students, who were divided into two groups.

In this work we carry out a statistical study of the grades achieved in a similar test with PBL and CL methodologies, as well as the grades achieved in students group works. Furthermore, we analyse the main differences regarding the opinion survey responded by students and the drop-out rate. Some statistical techniques, such as Kolmogorov-Smirnov test, t-test or Hypothesis Test for Difference Between Proportions have been used in order to develop the statistical analysis. As far as we are concerned, no studies of this nature which make a comparison between CL and PBL have been published. Hence the importance of this study.

From this study we can conclude that students’ academic performance (regarding the grades given) is greater with PBL than with CL. To be more specific, the difference is between 0.5 and 1 point for the individual tests. For the group tests, this difference is between 2.5 and 3 points. Therefore, this study refutes the fundamental hypothesis formulated at the beginning. Some of the possible interpretations of these results are referred to in this study. Regarding the opinion survey, students have a good opinion about both methodologies and believe to have acquired a deep knowledge in the two of them. On the other hand, we have to admit that, statistically, students that followed CL methodology found more difficulties to understand the text book to be studied.

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Session: 09C Area 1: Collaborative and Social Technologies - Collaborative and projects works

Distributed Collaborative Homeworks: Learning Activity Management and Technology Support

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Tools for Collaborative Development of Visual Models and Languages

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Embedding Sustainability in Capstone Engineering Design Projects

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Project-Based Collaborative Learning of Electrical Master Students

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Distributed Collaborative Homeworks

Learning Activity Management and Technology Support

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Abstract—We describe use of partially distributed collaborative assignments in a Usability Engineering course with respect to (1) learning activity management and (2) technology support.

Keywords- collaborative learning, case-based learning, collaborative software, learning technology, usability engineering

I. INTRODUCTION

The engineering students of today will most likely work in partially distributed teams during their careers, as network mediated collaboration becomes more routine. During the past three years, we have been experimenting with partially distributed team assignments in an upper-level undergraduate course in Usability Engineering at Penn State (for details, see <http://ist413.ist.psu.edu/>). These assignments employ *case-based learning* [3, 5]: the students analyze and apply ideas from online case studies documenting real-life professional practices in usability engineering to their own design projects (<http://ucs.ist.psu.edu>). The assignments also employ *distributed collaborative learning* [4]; the students are asked to work together outside of class using collaborative software over a period of time ranging from several days to several weeks to develop a design analysis or prototype, and a report describing their work.

An example assignment we have used asks student teams to develop a user interface prototyping strategy for a web-based information system. Each team member reviewed a case study in which prototyping was employed to identify candidate prototyping ideas and approaches, and to make specific recommendations to the team. The team evaluated, selected, and integrated these proposals to compose a joint report.

II. LEARNING ACTIVITIES

We are addressing three types of learning objectives. First, we want students to learn about and practice applying specific usability engineering concepts and techniques (like user interface prototyping). Second, we want students to exercise and develop their collaborative abilities (for example, learn to critically evaluate their team's ideas). Third, we want students to get experience using collaborative software applications.

We have found that students need a lot of scaffolding for these activities. It is critical to provide explicit guidance on

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collaboration itself. If collaborative process-goals are not explicitly stated, students may simply divide up the work and engage in minimal interactions. For this reason our students are also directed to practice a role-based approach to collaboration [1,2] in carrying out this assignment, and to make their collaborative process clear in the chats and other work products they create. The collaborative activities need to be analyzed into phases and students need to be supported and assessed through various phases. We detail our experiences and results in defining and managing distributed collaborative learning activities.

III. TECHNOLOGY SUPPORT

Through the past three years, we implemented our distributed collaborative homeworks using an open source toolkit that supports integrated synchronous and asynchronous interactions (Basic Resources for Integrated Distributed Group Environments, BRIDGE, [4]). The software supports team editing of reports as well as commenting on and construction of new cases in the library. We have found that collaborative software is sometimes too tightly integrated to be effectively used by student teams. Email in particular is problematic in that students rely on it, but already have email clients and accounts outside the collaborative suite. We are developing an open, Web-based collaborative workspace to help students integrate their existing tools and practices with support for collaborative learning. We detail our experiences with collaborative learning environments and illustrate our current collaborative workspace approach in more detail.

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Tools for Collaborative Development of Visual Models and Languages

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Abstract— The paper describes the design and implementation of a set of visual modeling editors. They aim to provide users with easy to use and customizable but yet semantically powerful tools for collaborative modeling in diverse domains of interest. The tools allow the creation, use and evolution of visual models and their underlying languages. The design, software architecture, technical implementation and graphic user interface of visual modeling tools are discussed. The results of current field trials with the tools are also briefly outlined.

Keywords— collaborative semantic modeling; ontology; visual models

SUMMARY

Collaborative design is a core element of engineering activity. The aim of collaborative design projects is not just students to learn how to solve practical problems but also to understand and to be able to articulate why a particular solution is supposed to work. Collaborative modeling constitutes an important knowledge practice in quite many professional and scientific communities as well as various educational settings and can be used as a means to foster shared meaning making and reflection in collaborative design. In the case of university education (at least in engineering), collaborative techniques and the use of visual models has still a long way to go. Recent advances in semantic web technology provide new and more powerful means to support collaborative modeling, but so far respective applications have been overly complex to use and hardly in line with the pragmatic requirements of knowledge workers and students.

To answer these challenges the paper considers the design and implementation of a set of visual modeling editors. The described tools are part of the web-based collaborative working and learning Knowledge Practices Environment (KPE) currently under development in the Knowledge-Practice Laboratory project (KP-Lab).

The tool set consists of two core components: the Visual Model Editor and the Visual Modeling Language Editor.

The Visual Model Editor allows users to create and evolve visual models in the form of two-dimensional graph diagrams such as flow-charts, argument-graphs, organigrams, decision trees, program logic models, conceptual maps, etc. both individually as well as collaboratively. The syntax, visual appearance as well as semantics of the visual models are

specified by the respective visual modeling language the model is built on.

The Visual Modeling Language Editor in addition allows users to create, share and edit the visual modeling languages as such, thereby providing users with the possibility to create their own domain specific ontologies.

Core features implemented in the current release of the KPE visual modeling tools are:

- Support for collaborative development of visual models as well as the underlying modeling language. The system allows for a controlled evolution of a modeling language preserving consistency with selected existing instances of it. It allows for choosing between different modeling languages.
- Support for creation of a shared understanding by specifying the semantics of the modeling elements used.
- Model comparison – either to assess similarities and alternatives, or to assess consistency of different descriptive aspects such as organigrams and workflows.
- Support for both synchronous and asynchronous collaboration. Users can work on the same model at the same time and changes are propagated in real time to all members of the group or users can work on the same model at different times and when they get back to the system they can retrieve the changes. Moreover visual models can evolve not only based on direct user-inflicted changes but also because the underlying visual modeling languages can also evolve.
- Support for customization and personalization of the modeling languages and constructs a user can select in order to realize didactic practices and to adjust the complexity of the tool to the abilities of the user.

The software architecture, technical implementation and graphic user interface of the tools are considered. Pedagogical scenarios to be supported by these tools are briefly outlined. The prototype is used in two university courses to test tools usability and pedagogical utility under real world conditions. A short overview of an initial field trial with the prototype is provided. Finally future plans are discussed.

The reported work is developed within the Knowledge-Practices Laboratory (KP-Lab) project funded by the EU 6th R&D Framework program.

Embedding Sustainability in Capstone Engineering Design Projects

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Abstract—The pace of change in education curriculums is growing exponentially due to numerous legislative arrangements and changes. Carbon tax, carbon pollution reduction schemes, emissions trading legislation are paving the way for environmental accountability in engineering industry. Engineering education moves into the twenty first century charged with an environmental agenda due to response to wider changes in society. Educators are regularly modifying curriculum content to embrace sustainability in learning outcomes. However this crosses over between a number of multi-disciplinary, multi-dimensional study areas that include philosophy and ethics. Consequently a major challenge for educators is to encourage engineering students whose primary focus is purely technical to include sustainability viewpoint in their designs. Unlike technical or financial evaluations where measures are either empirical or numerical estimates, sustainability position includes criteria in economic, natural, social, technological and time indicators. For the most part sustainability evaluations are content and competency driven and rely sometimes on rather intangible and proximal criteria. These criteria form the basis of assessment for measuring the sustainability of a design. The purpose of this article is to present various criterion, and indicators available to evaluate sustainability in engineering designs feasibility assessments. The paper presents the application of sustainability design criteria in the context of capstone design projects by way of applying social, economic, ecological, technological and time SEETT framework. These criteria form the basis of sustainability education embedment in engineering capstone design projects. Finally this paper argues the thesis that Sustainability feasibility studies and assessment in capstone engineering design projects are of grave importance for the success of the new frontier

Keywords—Engineering education model, capstone, new century, indicator, criteria, sustainability, design, assessment feasibility.

SUMMARY

The engineering industry uses vast quantities of natural resources (energy, water, materials and land), and produces products and services. Sustainability is a societal challenge; that also requires the contribution of engineers and technologists. The application of sustainability in engineering is about the implementation of sustainable product and process for the benefit of wider community. Consequently, traditional engineering curriculums were entrenched in the industrial needs of the 19th century; today the new 21st century engineering education model needs to incorporate 21st century principles and ideals including sustainability in the

engineering curriculums. However the increasing knowledge needed to practice as a professional engineers and the accelerating rate of change within the discipline suggest that traditional learning models may not address the requirements of learners [1]. Then again the concept of sustainability falls outside the regular numerical subject engineers are classically skilled for. The notion of sustainability education in engineering curriculums is growing at different levels in literature. Although there are a number of independent efforts to fold environmental issues in existing undergraduate curricula like the Barcelona Declaration Engineering Education in Sustainable Development EESD 2004 which described today's engineers need to acquire new dimensions in ethical, social and cultural issues and systemic vision. No dominant method has emerged as a means of including these concepts. One of the difficulties in adjusting our materials science and engineering (MSE) curricula is the problem of how and what to include in an already full curriculum. Therefore the challenge for the 21st century engineering education model 21EEM is to educate engineers in non-technical issues, which deal with the social subject. This is not to suggest that mere training- equipping engineers with the available analytical tools would be enough to achieve sustainability. Sustainability's position in 21EEM would require not just new tools but what's more a new role, being "bilingualism" across disciplines. Therefore, interdisciplinary learning outcomes need to take preference in (21EEM) curriculums to educate the new generation of engineers and technologists. Another vital issue that requires attention in curriculum development is the prima facie of incompatibility between the promotion of an environmental ethic 'sustainability virtues, greener' ideals in education and the political liberal's commitment to 'neutrality' "... the state is not to do anything intended to favor or promote any particular comprehensive doctrine rather than another, or to give greater assistance to those who pursue it..." engineering expertise would need to contribute at an early stage in the framing of problems, not just in problem solving; i.e., engineers should have a normative role as well as their more familiar analytical role. The idea of engineering adopting (or returning to) a normative role can be understood by examining the kinds of decisions in which professional engineers as decision makers may be involved with, this presented is as a useful classification of decisions

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Project-Based Collaborative Learning of Electrical Master Students

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Abstract—The paper outlines a project-based collaborative learning methodology developed for graduate courses on Electrical Drives and Power Electronics in Tallinn University of Technology. An underlying principle of the described environment is the coursework arrangement directed to designing optimal application-specific drives with power electronic converters based on the active learning approach. The role of advanced computer-aided design tools is also identified and shown. To illustrate the effectiveness of this method, the industry-relevant course projects performed in the curriculum are presented in detail. An important result found is that all students acquired knowledge and skills to design more complex and sophisticated electromechanical systems.

Keywords—active learning; collaborative learning; project-based learning; electrical drive; power electronics

SUMMARY

The paper outlines the active learning and teaching methodologies used in the graduate courses. An underlying principle of the described environment is the coursework arrangement for the development of optimal application-specific drives with power electronics converters. The paper analyzes the benefits and restrictions of the active project-based collaborative learning techniques based on their implementation experience in the master study program of Tallinn University of Technology. The description of each method is followed by the recommendations concerning possible ways of their use in electrical engineering education.

One example of active learning is the system built by the authors to study the advanced courses Electrical Drives (AAV0040) and Power Electronics (AAV0050) timetabled in the Faculty handbook.

To implement project-based learning, the traditional style of lectures was changed. Accordingly, if necessary, practice and lab work may precede lectures. In the lectures, problem scenarios are presented to the students before any relevant theory or practice is given. The open problems are framed by the teacher in accordance with the topics in the syllabus and a lecturer acts as a contractor who asks the students (acting as subcontractors) to design and implement a fully functional motor drive or electronic converter that covers most of the topics reviewed in the theory lessons. The first classes are spent

creating a systematic design of the final product – the specifications and main functions are described, and a functional block diagram is conceived. This policy means that students find the explanation of systems and ideas to be useful because they can see the target application. In addition, the start-to-finish design, from the block diagram until the final implemented system, helps the students in the task of determining, solving and grasping the problems. During the next lessons, the lecturer reviews the designs and products and advises the students about the possible errors or mistakes. Therefore, the teacher is responsible for ensuring that each student's design is correct and that the final prototype is a working unit. Finally, he/she also acts as a vendor as the final prototype is usually implemented on the prototype boards.

The specially prepared textbook and its web release involve the sections supported project-based learning. They accompany the lectures for beginners and for advanced learners summarizing the common terms and conditions as well as the topical mathematical basing of the course, explain the broad self-learning part of the course, and give the calculation examples, experimental and assessment problems of the course.

Collaborative learning has become a necessary part of the project-based approach. To stimulate teamwork, a specific team-based methodology has been developed. The goal of the collaborative design is to build effective real-world electromechanical equipment.

One of the typical course projects is devoted to the design of the robot drive system. The work includes two stages: the stage of individual creativity and that of collective work, particularly via the Internet. These phases are detailed in the paper.

As a result of the project-based collaborative learning, the average student final grade increased 1,4 times as compared to the traditional approach and reached 4,3 on the 5-based assessment scale. The students interested in active approach obtained the highest scores whereas the weak students also improved their results to some extent.

An important result is that all students have learned to design more complex and sophisticated electromechanical systems.

Session: 09D Area 4: e-Assessment and new Assessment Theories and Methodologies - Theories

Ensure Program Quality: Assessment A Necessity

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Paper-Based versus Computer-Based Testing in Engineering Education

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Methods of the quality assurance applied at remote laboratory selection

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Introducing alternative assessment into engineering language education at the Madrid Technical University

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Ensure Program Quality: Assessment A Necessity

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Abstract: In an effort to achieve high quality programs and courses both formal and informal measures are used the teaching and learning process through direct and indirect methods. Assessment has become even more important since education institutes show great interest in the educational experience outcomes and how they map to institutional goals as well as to the needs of the society. Institutes either develop a formal internal assessment process or through external accreditation try to continuously improve and revamp their programs. It is now perceived that students are more active in building their knowledge rather than simply listening to the lectures. Assessment of student work therefore helps us to determine the effectiveness of programs from student's point of view. This also gives an opportunity to the students to show us what they have learned and how they can contribute when they graduate. It is therefore all that important, for institutes interested in accreditation, to assess learning outcomes as a component of program review process. This paper addresses the necessity of assessment through seeking accreditation and also provides a more structured mechanism for accessing, evaluating and improving the quality of the program. This paper details various assessment tools (AMS, Web-Based, Directory Structure, etc.) used by different institutes, to help in organization and gathering of the related material. The paper also presents a model for sharing responsibilities to monitor and evaluate gathered material and assessment data

SUMMARY

All of the academic institutes wish to provide good quality programs. This wish leads to a collection of good quality courses to ensure program quality. In an effort to achieve quality among the courses assessment becomes an essential part of the program using direct and indirect measures. We see a widespread interest in the educational experience outcomes and their link to the goals for students, institutions and society, making assessment even more important instrument. Institutes achieve continuous improvement through the review of their academic programs either through external accreditation or a formal internal assessment process. Assessment in higher

education goes back to many years and still emphasizes importance of student learning. In that respect, assessment gives us an opportunity to evaluate effectiveness of our programs from the learner's perspective. In addition it gives an opportunity to students so they can show what they know by the time they graduate. One of the ways to ensure this is by assessing learning outcomes of the program. In general, universities support the assessment of student learning as an integral part of their core commitment to graduate students with high value degrees. Institutes in general review their academic programs, to ensure continuous improvement, through a formal automated or manual internal assessment process. It is a general understanding that preparing for an accreditation visit is a huge task. However, the accreditation guidelines on the contrary, suggest that accreditation should not be viewed as a discrete event rather it is a continuous and progressive process. This paper addresses the necessity of accreditation and tries to answer a common question "Why should a program seek accreditation? The paper argues that accreditation provides a structured mechanism to assess, evaluate and improve the quality of the program. This paper details various assessment approaches used by various institutes seeking accreditation. Computer assisted assessment help in organization and gathering of the related material. It also helps in assessing the material gathered at various levels. A brief review is provided of different tools (AMS, Web-Based, Directory Structure, etc.) that can be used in preparation for accreditation and collecting data for program assessment. The paper also presents a Hierarchical Model for sharing responsibilities to monitor and evaluate gathered material and assessment data.

Paper-Based versus Computer-Based Testing in Engineering Education

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Abstract-- Using computers for assessment can provide several benefits for educators and test-takers. However, in the literature, there is no consensus on the equivalence of paper-and-pencil and computer-based test environments. Accordingly, more evidences are needed especially for the engineering education. In this study, students' performance on different test modes was evaluated on 209 first year engineering students of a chemistry course. The results of this study showed that, there is no significant performance difference between paper-and-pencil and computer based tests. By comparing results with the previous studies, this study concludes that, personal characteristics of test takers, the features of computer-based testing systems and the test content are all possible confounding factors when comparing test modes and need to be considered by the implementers. The results of this study show that, once these factors are controlled, students' performance on computer-based tests and paper-and-pencil tests in chemistry courses for the engineering students will not vary. This finding is encouraging the educators to get benefits of computer-based tests without any affect on students' performance.

Index Terms— Computer based exams, Test-Mode Effect, Paper-and-pencil Based Exams, engineering education

SUMMARY

Exams are an important instrument of student assessment. As stated by Brown, Race and Bull [1] the style of assessment can have an important influence on student learning. Depending on the number of students, it is not easy to implement such techniques more often. In that sense, Computer Based Testing (CBT) systems can provide alternatives for implementing tests more often on different educational settings. Mode of presentation of assessment can significantly influence student performance [2]. Questions about differential impact of paper-and-pencil (P&P) versus CBT on test performance are referred to as test mode effects. Reports in literature reveal that both modes of tests (CBT and P&P) are some how different from each other and there is no consensus on the equivalence of P&P and CBT. Accordingly, this study aims to evaluate and compare engineering students' performance on P&P and CBT.

This study was conducted within 209 students. Main research question of this study is,

Do engineering students perform better or worse on computer based test compare to paper and pencil test?

In order to answer the research question, in the second midterm of the Chemistry Course, the students were randomly divided into two groups according to their last names. The first group of the students (96 students) took the CBT version; whereas the second group of students (113 students) took the exam in P&P form. To measure examinee characteristics such as gender, department, computer ownership, computer experience and CGPA, a questionnaire was used.

The results of this study show that, students' performance on the CBT and P&P versions of the exam does not differ significantly. The qualitative data also supports this result. There were some differences between the computerized and P&P versions of the exams (i.e. number of questions in each page and question numbers). However this difference did not affect the test results significantly. Gender effect was also tested and any relation between gender and test mode could not be found.

This study also reveals that, characteristics of test takers, features of computer-based testing systems and the test content are possible confounding factors when comparing test modes. Once these parameters are controlled, on CBT, similar test performance can be reached with the P&P tests. This result is very promising to better get benefits of the CBT environments in classical and distance learning environments.

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Methods of the Quality Assurance applied at Remote Laboratory Selection

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SUMMARY

The quality assurance methods applied at remote laboratory network, there is similarly with the same methods applies at production processes which has as results products, used by our society. In our concept, the remote experiment there is a product used by students, a part of our society, with the main reason to increase the quantity and quality of knowledge. Learners are the consumers and teachers are the producers. At limit, when is used the remote laboratory network, one student must to open all of the remote laboratory works referred at the same experiment to be able to declare that his knowledge and image about the referred subject there is complete. It is practically impossible, so that a selection method there is necessary. But, as in the classic production process, there are too many laboratory works in comparison with the time existed at the student disposal and also, there are a various grades or levels of quality of each remote experiment. These differences are the result of intentional design of the laboratory works, determined by the some factors take into account by the producer (teacher): level of the laboratory endowment, level of the Internet connection, type of the subjects approached in the remote way, acceptance of the national language and/or translation in the English language (bilingvistic design). All of the above factors being intentional and restrictive in the moment of the design of the laboratory remote experiment, the quality aspect there is named: QUALITY OF DESIGN.

There are other factors which influenced the quality of the remote laboratory. They are: hardware and software used for remote experiments (many times restrictive for some utilizers), level of knowledge of producers (teachers) and consumers (students), type of the quality assurance system inside of the schools, assessment and evaluation system of the students, etc. It is speaking, in the consideration of the above factors, about the QUALITY OF CONFORMANCE.

How well the laboratory work (as product) conforms to the specifications required by each training system, existed outside from the own system? There is considerable confusion in the field of the remote laboratory network when it is analyzed in accordance with the quality standards, because these two above terms are often used without making clear whether it is quality of design or quality of

conformance. Being a global system, remote experiment network will include a conflict between: quality of design, which is a local decision, with quality of conformance, which is a global requirement. In the paper the authors try to propose a statistical method for selection between experiments posed in the remote laboratory network, so that students to be helped to not lose their time visiting all of the existed, to have a complete opinion. Inspired from acceptance sampling method for attributes, the paper described a double sampling method where the information from both, the first and second sample, is combined in order to reach a decision whether to recommend or not to the student an experiment.

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Introducing alternative assessment into engineering language education at the Technical University of Madrid

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Keywords-component; Assesment, Higher education, Second language, Self assessment

SUMMARY

Engineering Institutions across Europe are currently involved in a major process of reform and restructuring as part of the Bologna Process, which stresses the role of competencies and outcomes in curriculum design. In the field of languages, the Council of Europe has developed the Common European Framework of References for Languages (CEFR), which aims to provide a reference framework for describing different qualifications, identifying different language learning objectives and setting out the basis of different achievement standards. It serves as a practical tool for fixing clear standards to be attained at successive learning stages and for evaluating outcomes in an internationally comparable manner, presenting a scale of language achievement divided into 6 levels clustering into 3 bands: A1-A2 (basic user), B1-B2 (independent user), and C1-C2 (proficient user). Shortly after the implementation of the CEFR, a second instrument was initiated, the European Language Portfolio (ELP). It is made of three parts: the passport, the biography and the dossier. Our research group, over a three year period, has developed and piloted the The Academic and Professional English Language Portfolio (ACPEL) especially designed for Engineering students and professionals. This portfolio was accredited by Language division of the Council of Europe in 2008. It is made of three parts: the passport, the biography and the dossier. The portfolio contains 350 descriptors or learning outcomes which encourage the learner to self assess by stating what he/she can do in each language. The aim of the ACPEL is to educate students to become autonomous, life-long language learners that can realistically assess their proficiency in the different language skills and can communicate this to institutions for further education, employers and other interested parties.

This paper will report on an ongoing project dealing with self and peer assessment based on the the ACPEL portfolio. Self assessment is a process where students are involved in and are responsible for assessing their own piece of work. It encourages students to become independent learners and can increase their

motivation. Peer assessment is where students are involved in the assessment of the work of other students. Research evidence, outside if field of language learning, report that students experience increased self -esteem, increased engagement with learning, especially goal setting, clarifying objectives, taking responsibility for learning, and/or increased confidence. Students and language professionals involved in the project are drawn from 7 different degree programmes: Architecture, Technical Architecture, Technical Aeronautical Engineering, Agricultural Engineering, Civil Engineering, Technical Mining Engineering, and Mining took the placement exam.. The project's aim is threefold: first, to train university language professionals in the use of self and peer assessment through the implementation of the ACPEL portfolio; secondly, to gradually introduce these assessment processes into the engineering language curriculum and finally to monitor and evaluate these two processes at the seven engineering schools.

Self assessment is a process where students are involved in and are responsible for assessing their own piece of work. It encourages students to become independent learners and can increase their motivation. Peer assessment is where students are involved in the assessment of the work of other students. Research evidence, outside of the field of language learning, report that students experience increased self -esteem, increased engagement with learning, especially goal setting, clarifying objectives, taking responsibility for learning, and/or increased confidence. Assessment is acknowledged as a major influence on student learning. Thus, all assessment activities need to be examined from the point of the view of what they contribute to prompting student learning which should be the intended outcome from the course. Assessment needs to be demystified to allow students to become confident enough to use it as well as make connections between assessment activities and learning. Since students will inevitable have to make their own assessments in the real world, ample opportunities should be offered to practice this skill.

Session: 09E OCW-Universia Special Session: OCW and Open Educational Resources

OCW Consortium: learning through the worldwide sharing and use of free, open, high-quality education materials organized as courses

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Role of regional consortia in OCWC: OCW-Universia

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Development of the OCW Consortium

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MIT OpenCourseWare - OpenCourseWare Consortium

OCW Consortium: learning through the worldwide sharing and use of free, open, high-quality education materials organized as courses

Special Session

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Abstract— A special session is proposed to present the current status of OpenCourseWare Consortium from different viewpoints: from the OCWC Board of Directors's view, UNIVERSIA as leader of a regional OCW consortium, and best practices of other universities.

Keywords: open educational resources, ocw

I. INTRODUCTION

Global educational systems are unable to meet current needs. Systems of primary, secondary and higher education around the world are struggling to find the resources and trained educators required to meet the demands for education and certification, particularly in the face of rapid population growth and economic development. The current global economic crisis exacerbates these problems through the creation of a displaced labor force in need of retraining at a time when resources supporting educational systems are further diminished.

Technology is an increasingly disruptive force on educational systems, both positively and negatively. The Open Educational Resources (OER) movement is a trend toward the creation of openly-licensed resources including open references such as Wikipedia, open access journals, open educational technologies, open text books, open data sets, open learning object repositories, shared resources such as iLabs and many others. Open educational resources are proliferating in type and number. There is a rapidly increasing number of open educational resources attracting ever-higher levels of use. As of yet, few synergies have emerged between these related but separate undertakings, and as a whole the movement often provides a confusingly kaleidoscopic array of resources and opportunities. The progress and promise of OER, however, both remain substantial. Open educational resource creation and use is becoming a widespread global best practice. The spread of OpenCourseWare publication, open access publication, as well as the use and integration of OER into new materials, are all increasing. Forums such as the UNESCO-OER mailing list are bringing together a global OER community.

The OpenCourseWare (OCW) project, as part of the OER movement, started at the Massachusetts Institute of Technology (MIT), in the year 2001, with the aim of offering pedagogical materials in an open and free of charge basis to society. The mission of the OpenCourseWare Consortium is to advance formal and informal learning through the worldwide sharing and use of free, open, high-quality education materials organized as courses. An OpenCourseWare (OCW) is a free and open digital publication of high quality university-level educational materials – often including syllabi, lecture notes, assignments, and exams – organized as courses. This philosophy is being spread to the world main universities creating the OCW Consortium (OCWC), in which more than 250 universities and associated organizations worldwide committed to advancing OpenCourseWare sharing and its impact on global educational opportunity. The OpenCourseWare Consortium (OCWC) has been formed [4] with the proposal of expanding the reach and impact of opencourseware by encouraging the adoption and adaptation of open educational materials around the world.

II. FOCUS AREAS

Papers of this special session will highlight some of the work related with OCW movement with representation in the following areas:

- The OpenCourseWare Consortium (OCWC) is undergoing a period of rapid growth and organizational development. The number of participating institutions, live OCW sites, and total available courses are all increasing rapidly. The Consortium is straining to develop the organizational structures needed to accommodate this growth. The OpenCourseWare Consortium is just developing as an organization. We will count on the representation of the OCWC Board of Directors of the OCWC to explain how the Consortium faces the dual challenges of developing initiatives to support Consortium goals and developing the systems and infrastructures needed to operate the organization.

- Subconsortia are emerging in increasing numbers around the world. Regional groupings of OpenCourseWare projects are emerging around the globe, bringing large groups of universities into the OpenCourseWare Consortium. UNIVERSIA, one of the greater networks of university cooperation, which merges 1,070 universities and higher education institutions in 11 countries of Latin America, leads the OCW UNIVERSIA and tries, under the cultural and geographic affinity of the Latin American space, to facilitate the presence of the institutions of higher

education of this region in the world-wide OCWC and to promote the open publication of its courses and others educational contents in the languages of our community. The OCW Universia view for our current situation will be presented in this session.

- The consortium helps you create content—more effectively and more efficiently—by providing an environment for the sharing of best practices among our members. Some of these practices developed by other technical insitutions will be presented.

Development of the OCW Consortium

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Abstract—This paper documents the development of the OpenCourseWare Consortium, from the origins of the OCW concept at MIT and that Institute's early commitment to supporting other adopters of the model, to the rapid growth of the community in the period 2004-2007, to the Consortium's incorporation as an independent entity and current activities and status.

Keywords—OpenCourseWare; open educational resources

I. A NEW MODEL FOR OPEN SHARING

In the year 2000, an MIT faculty committee on lifelong learning made a proposal that was as simple as it was revolutionary. The committee was charged with recommending a strategy for MIT in confronting the growing impact of the Internet on higher education, and in particular, in confronting the emerging field of digitally supported distance learning. After surveying the online education landscape, they saw that distance learning was both difficult to provide profitably and at some level fundamentally at odds with the Institute's mission to disseminate knowledge. Online education—as it was conceived at the beginning of the century—would take the academic riches of the Institute and lock them behind a firewall for only those who could pay.

Instead, the committee proposed, why not use the Internet to give away the academic content at use in MIT's classes? Rather than trying to create entire new programs specifically designed for online delivery, why not take the core academic documents already created at the Institute—the syllabi, lecture notes, assignments and exams handed out in MIT classrooms—and make them widely and freely available on the World Wide Web? Instead of pursuing profit, as was the prevailing model, the committee suggested the goal should be generating global benefits through a philanthropic approach.

In sharing these materials, the committee hoped to provide educators around the world resources they could build upon in creating materials for their own classrooms. They also hoped to provide students everywhere with access to additional resources to supplement the materials they received in their classes. Independent learners, too, might benefit from accessing these materials to learn for pleasure or to solve professional problems. Rather than online instruction, the committee hoped to provide open resources that would benefit the widest possible population and change the overwhelmingly commercial direction of online higher education.

As sweeping as this vision was, the faculty had a more ambitious idea. They recognized that if MIT undertook such a program, it might provide benefit to hundreds of thousands, maybe millions, but the concept—which they dubbed OpenCourseWare (OCW)—would not fundamentally change education unless it was widely adopted by universities around the world. As they sought funding to start the program, which was quickly provided by the William and Flora Hewlett and Andrew W. Mellon foundations, they proposed that in addition to publishing all of MIT's educational materials, the team assembled would also provide advice and assistance to other schools seeking to publish their materials openly. It was this commitment that would, in five short years, result in an independent organization with a globally distributed staff that serves the needs of more than 200 universities and affiliates—the OpenCourseWare Consortium.

II. SERVING PRODUCERS AND USERS OF OCW

The Consortium today supports emerging OpenCourseWare projects, builds global awareness and use of OpenCourseWare materials, and connects the vibrant OCW community to the education, government and private sectors. More than 200 universities around the world participate in Consortium activities, and collectively they have published materials from an estimated 13,000 courses in more than 20 languages. Volunteers around the world have translated an additional 3,500 courses from their original language.

In a very brief span of time, the OpenCourseWare Consortium has grown from of a common commitment to serving world educational needs through an innovative model into a global organization supporting a diverse community of OCW users and producers. The Consortium faces the significant challenge of transitioning from grant funding to sustainable sources of revenue including significant member support. To begin the transition, the Consortium introduced membership dues this year of between US\$50 and \$500 depending on membership category and member region. In a demonstration of commitment to the Consortium, a core group of leading universities and organizations, including most of those described throughout this paper, have each pledged US\$5,000 per year in each of the next five years to the Consortium. This statement from across the community indicates the strength of the OCW movement and suggests Consortium will be supporting the production and use of OpenCourseWare materials for many years to come.

Session: 09F VISIR Special Session: Workshop on VISIR electrical and electronic remote lab: Principles and educational view

Workshop on VISIR electrical and electronic remote lab: Principles and educational view

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Session: 10A Area 1: Adaptive and Personalized Technology-Enhanced Learning

Indexing and Searching Learning Objects in a Peer-to-Peer Network

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Public Displays and Mobile Devices in an Augmented Objects Framework for Ubiquitous Learning

Madeira, Rui Neves
ESTSetúbal/IPS (Portugal)

Adaptation in a PoEML-based E-learning Platform

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University of Vigo (Spain)

Madar learning : learning envirnment for E&M learning

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Indexing and Searching Learning Objects in a Peer-to-Peer Network

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I. MOTIVATION

Our idea is to use Peer-to-Peer (P2P) networks to disseminate learning objects that act as anchors for creating collaborative learning communities. In a previous paper, we have analyzed the limitations of current e-learning tools and outlined the design choices for an e-learning tool based on P2P and VoIP technologies. The goal of our project is to create collaborative spaces of learners with similar interests to exchange knowledge, opinions, and experience so that they can learn, understand, and help/teach each other. A P2P network may provide easy access to educational resources without the need for third party Web servers, which often require considerable management and maintenance effort. In a similar way to video or music files, complex learning objects in a standard format such as SCORM may be easily disseminated among interested learners, because P2P networks operate in an autonomous and spontaneous way with a minimal management overhead. The advantage is that users can use P2P applications with little or no training.

The use of the P2P technology for disseminating learning objects requires extending current P2P systems with a support for precise indexing and searching. In this way, potential learners can easily find and choose relevant objects. Moreover, we also want to use learning objects for creating collaborative communities, so our objects need to become communication anchors between the members of the community, for instance by keeping a contact list (e.g. SIP addresses) of all users interested in a given content and that have already downloaded a given learning object. The present paper describes the design of an indexing and searching scheme for disseminating complex mutable SCORM learning objects over BitTorrent.

II. MAIN CONTRIBUTIONS

We consider learning objects in SCORM 1.2 format that allows linking various resources and adding descriptions in the LOM format. We want our learning objects to evolve: learners in a collaborative community can enhance the existing content and add more resources. We also need to add contact information for all users downloading the object. However, existing P2P objects like an MP3 or a video file are immutable, i.e. they cannot be modified once published on a P2P network. Thus, we need to enhance the structure of P2P objects so

they can be modified within a collaborative community. We obtain this goal by associating an identifier to a learning object (LOID) and allowing for multiple versions identified by a version specific VSLOID. Their association with a *torrent* allows to download a given learning object.

A. Metadata and domain ontology

We propose to enable precise searching through the use of *metadata* extracted from a learning object such as traditional attributes Author, Title, Description, as well as *concepts* from a domain ontology defined for a given class of learning objects. Domain ontology is a network of domain model concepts (topics, knowledge elements) that defines the elements and the semantic relationships between them. Indexing consists of creating an inverted index that associates metadata information with a given VSLOID representing a learning object. All needed associations (e.g. between LOID, VSLOID, and a torrent) as well as the index information are stored in an open distributed storage service OpenDHT as (*key, value*) pairs. For instance, the index of the Author attribute: Author_Smith \rightarrow VSLOID is stored as a (Author_Smith, VSLOID) pair. We also store ontology concepts by adding Ont prefix to a concept, e.g. Ont_digital-camera \rightarrow VSLOID as well as a SIP address (COM_'VSLOID' \rightarrow SIP-ID) for easy contact within the learning community.

B. Searching

The user can specify search terms such as title, author, or keywords and choose a concept from a domain ontology. Parent terms of the concept are automatically added and the system queries OpenDHT to find relevant VSLOIDs. The results are presented to the user who can choose an object for downloading. Its SIP address is added to the object and she becomes the member of the community related to the object.

C. Implementation

We have developed GLEN (Global Lecture Exchange Network), a prototype of a P2P client based on Azureus (Vuze). We have extended the Azureus interface to offer the function of adding a learning object and searching the network. The indexing and searching schemes presented above use the DHT functionality of OpenDHT. In the paper, we provide more information about the indexing and searching scheme.

Public Displays and Mobile Devices in an Augmented Objects Framework for Ubiquitous Learning

DSI/E

rm

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Abstract— We are facing promising developments in the area of mobile services where context-aware systems can take the location and position of a user, her preferences and ‘smart’ objects into account, adding (implicit) interaction between a mobile device (of the user) and the real world. The assimilation of ubiquitous computing by education marks an important step forward, as being pervasive and persistent it allows students to access education calmly, flexibly, and seamlessly. This paper focus on a framework proposal with a well contained and defined application goal in Ubiquitous Computing and a prototype directed for Ubiquitous Learning environments. This system can augment physical objects in an educational environment with additional multimedia information, which is displayed in public shared displays according to the user (student or teacher) that faces the system. The information is contextual, based not only in the object, but also in its specific location, in the environment and in the detected user profile. A generic architecture was designed to help on the implementation of this augmented objects framework in any physical space.

Keywords- Ubiquitous framework, Mobile devices, Public displays, Augmented objects, Bluetooth, Ubiquitous learning context

SUMMARY

The assimilation of Ubiquitous Computing by education marks an important step forward as it allows, being pervasive and persistent, that students access education calmly, flexibly, and seamlessly. The integration of adaptive learning with UbiComp and Ubiquitous Learning (u-learning) offers great innovation in the learning process, allowing its personalisation and customisation to student needs. The term mobile learning is frequently used to refer to the use of handheld mobile devices that enable the learner to be ‘on the move’, providing anytime anywhere access for learning [1]. With the move of computation in to the physical environments in which we live and interact, mobile and ubiquitous computing also provide the opportunity to enhance and support learning in more ways than the ‘any where, any time’ conception, moving into the u-learning concept. One major opportunity is the facility to digitally augment the ‘real world’ by linking digital information with physical objects or the environment. Information can be displayed in different ways, e.g., it can be serendipitously ‘pinged’ through a user passive interaction by using embedded sensor technology and according to various conditions in the learning environment, or it can even be requested with an active interaction by a learner [2].

Following these concepts, this paper introduces a framework proposal and a system based on recognized technologies and directed for u-learning environments. The developed prototype, u-learnEST, is designed for user interaction with situated public displays using mobile devices. This system augments the physical objects, in a learning environment, with additional digital information. It displays information according to the user (student or teacher) that interacts with the system. The information that augments an object is contextual, based not only in the object, but also in its specific location, in the physical space and in the profile of the detected user. A generic supporting architecture is also presented as it was designed to make possible the implementation of this computing framework in any physical space. The implementation of the system u-learnEST was made at the installations of ESTSetúbal (Polytechnic Institute of Setúbal), for an engineering course, although the same concepts could be applied to other places. The main idea was to convert the laboratories of a specific course into big objects ‘visited’ by multiple users, automatically augmenting them with additional information every time a user is detected in its area. An instance of the system is composed by a situated public display, by a sensor server to manage detections, presentations and communications, and by the mobile devices of the users.

The paper is organized as follows. Section II presents a set of systems with points in common with our project. The requirements and guiding principles for the supporting framework are described in Section III. Section IV is dedicated to the presentation of the supporting framework, highlighting the generic architecture. Section V is dedicated to the implementation of the prototype u-learnEST, with relevance to the architecture instantiation issues and used technologies. Finally, in Section VI, conclusions are made and future work is presented.

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Adaptation in a PoEML-based E-learning Platform

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Abstract— In EML-based e-learning platforms for engineering education, adaptation can be focused whether in the EML meta-model or in the run-time environment. In the approach centered in the EML meta-model, adaptation is carried out by advanced modeling and late modeling. In the approach based on the run-time system, it is the run-time system the one that supports the change types that are allowed. This paper presents a conceptual framework and software architecture aimed to support late modeling in an e-learning system based on PoEML (Perspective-oriented Educational Modeling Language).

Keywords— CSCL, adaptation, late modeling

SUMMARY

During our study of current Learning Technology tools, we noticed that open-source ones are gaining a wide acceptance in learning institutions. Moodle is the most used open-source Learning Management System (LMS), with millions of users worldwide. Its GPL license, stability, and its great community of users and developers, are the main reasons for its popularity. Moodle allows a great flexibility when creating and delivering courses. When a course-creator makes a change in a certain course by using the integrated authoring environment, the change is immediately visible by all the students enrolled at the course. We term this approach as “on-the-fly authoring”.

Regrettably, course types in Moodle are poor from a pedagogical point-of-view, because they are restricted to self-pacing the contents and activities. All the resources and learning activities inside a course are available to be performed by any student at any time. Moreover, the content aggregation model does not support the hierarchical structuring of course sections, which would be a useful feature for ordering contents in a structured way.

During the last years, some initiatives aimed to provide control on the course delivery process have come into scene. Those initiatives, such as SCORM and IMS-LD, enhance the classical content-based delivery with control mechanisms such as activity sequencing and conditional activities. Control

systems provide and enhanced pedagogical utility and they allow course-creators to design complex learning structures. With that objective, we use an Educational Modeling Language (EML) named PoEML.

PoEML allows course-creators to describe in a machine-readable way the course contents and the delivering of activities to the participants in the course. A course is composed of learning resources and activities organized in a hierarchical structure of Goal-Based Scenarios, and the instructions for controlling the access of participants to the different scenarios, depending on the consecution of previous goals.

With such a control system, based on hierarchically organized Goal-Based Scenarios, it is possible to create different itineraries (learning paths) over the same reusable content structure. For example, over the same English Language and Linguistics course content structure, the learner Alice may follow a learning path focused on English verbs grammar, whilst Bob may follow a learning path focused on Spanish translation. Thus, over the same course content structure different learning paths can be followed. Hence, the PoEML-compliant control system is goal-based: both Alice and Bob have their own objectives when starting a course, and, in accordance with each one of those goals (verbs, translation) each learning path is a different one.

Adaptation in e-learning systems based on EMLs can be focused whether in the EML meta-model or in the run-time environment. In the approach based on the run-time system, it is the run-time system the one that supports the change types that are allowed. Here, these lines can be followed: type adaptation, and instance adaptation.

In this paper the follow a late modeling approach to allow a high degree of adaptation in our e-learning system based in the PoEML language. Late modeling allows for leaving some parts of the model unspecified until run-time.

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MADAR Learning: An interoperable environment for E&M learning

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SUMMARY

The rapid development we have been witnessing for some decades has placed digital information and computer networks at the core of most components of professional and individual life. Learning is one of the crucial fields of activity that have benefited from such technological development. During the last decade, integration of ICT gave birth to what is now called E-learning. The trend towards mobile technologies led to M-learning at the beginning of the current decade. The happening of these two learning environments has raised several research interrogations that revolve around the need to tap the progress by each one of these two environments for the benefit of the other. Our research group deals with this issue too. Coexistence between E and M learning has brought about the need for interoperability, which involves maximum use of technological breakthroughs in both environments and makes it, therefore, possible to build up an educational heritage, regardless of the technological learning tools used. We try to present our approach to create an E&M learning continuum. Key words: E-learning, M-learning, pedagogy, mobile technologies, MADAR learning, interoperability, standard, IMS LD, adapting standards, modular architecture.

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Session: 10B Area 3: Specific Engineering Disciplines - Professional Developments

ESA Hands-on Space Education Project Activities for University Students: Attracting and Training the Next Generation of Space Engineers

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A competitive collaborative learning experience in chemical plant design

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Introducing Project Management Theory into a Capstone Design Sequence

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Information Technology in Logistics: Teaching Experiences, Infrastructure and Technologies

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ESA Hands-on Space Education Project Activities for University Students: Attracting and Training the Next Generation of Space Engineers

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The ESA Education Office was established in 1998 with the purpose of motivating young people to study Science, Engineering and Technology subjects and ensuring a qualified workforce for ESA and the European space sector in the future. In achieving this, the ESA Education Office provides numerous opportunities for university students from ESA Member and Cooperating States to gain practical hands-on experience on real space projects. These opportunities cover a broad spectrum of flight project activities ranging from student experiment payloads on microgravity platforms, atmospheric balloons, and sub-orbital sounding rockets to instruments and small platforms for Earth and Moon orbiting satellites. The education satellite projects range in size from pico-satellites to mini-satellites and are complemented by a global network of education institution and radio amateur ground stations.

By participating in these projects, students gain the technical/programmable knowledge and practical skills necessary for entering into the space engineering workforce, and immediately making a solid contribution to the European space programme, thus underpinning and building upon European capabilities in the space domain. The product of these projects is a set of qualified, fully trained engineers covering not only specialist technical disciplines in space engineering, such as structural, thermal, avionics, instrument, propulsion, and ground segment, but also systems engineers capable of developing complete satellites from end to end.

Since ESA hands-on space project activities began in the mid-1990's with the first student parabolic flight campaign, through the completion of three student satellite projects, to the present day activities, it is estimated that over 3,600 students distributed over 22 ESA Member and Cooperating States have benefited. In implementing the programme, the ESA Education Office works closely with a wide network of engineering faculties in universities across Europe, with space industry companies and with ESA technical experts to ensure that supervision, seniority guidance, mentoring and knowledge transfer is provided to the participating students by experienced professionals. In this context, ESA Education Office, with its partners, also provides the necessary collaboration tools, software, facilities, independent technical

reviews, workshops, and internships sponsorship to enable an effective working environment. Launch opportunities are also provided in order to actually fly the student-built systems.

Past education satellite projects were the SSETI Express micro-satellite designed, built and tested by students, and launched into Low Earth Orbit (LEO) on a Russian Cosmos rocket in 2005; and the first and second Young Engineers Satellites (the latter being an in-orbit demonstration of space tether technology, which was carried on the ESA Foton-M3 microgravity mission in 2007). Ongoing student satellite projects include the ESEO (European Student Earth Orbiter) micro-satellite and the ESMO (European Student Earth Orbiter) mini-spacecraft, both currently under design and development by university students together with industrial prime contractors, and due for launch in 2012 and 2013 respectively. In addition, 9 university-developed "CubeSat" pico-satellites have been selected for launch on Europe's new small launch vehicle, Vega, in 2010. In support of future education satellite missions, the ESA Education Office is leading an international project called GENSO (Global Education Network for Satellite Operations) to establish a world-wide network of university and radio amateur ground stations in order to greatly increase communications coverage. The network is due for early operations in 2009.

Student experiments are developed and flown on a variety of platforms in order to encourage scientific research by students in subjects such as microgravity effects, atmospheric physics and technology demonstration. These platforms include the REXUS sounding rockets and BEXUS stratospheric balloons launched from Esrange in Sweden in collaboration with Swedish National Space Board and the German space agency, and the Airbus A300 Zero-G parabolic aircraft used for the Fly Your Thesis project (see other abstract on this topic).

This paper will describe the hands-on space education programme and its setup, the engineering education methods, and the knowledge/skills transferred to the students, in addition to summary technical information on the projects concerned.

A competitive collaborative learning experience in chemical plant design

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Abstract—This paper reports on the experience of using collaborative learning techniques in a competition environment, which can be a proper approach in the traditionally highly demanding and competitive engineering courses, avoiding most of the drawbacks attributed to collaborative learning methods. The students were organized in contractor “companies” with several technical departments and one project manager, competing at every stage of the design process. The final project included the main usual documentation of a professional basic engineering project. The results were good technically and well accepted by the students, but not all the drawbacks were removed.

Keywords- collaborative learning; engineering course; design project; chemical engineering

SUMMARY

In recent years, the collaborative learning paradigm has been increasingly incorporated in modern engineering courses. The term collaborative learning is one of the names that encompass a variety of learning/teaching techniques where students work together in small groups. Some of the advantages of this learning strategy are more comprehensive learning, lower failure and drop-out rate and a better understanding through peer discussion. Collaborative learning is said to foster creative thinking as members in a group generate new ideas, strategies, and solutions more frequently than working individually. Disadvantages include (time) inefficiency, unclear hierarchical structure and unfairness in grading. Also, active resistance to collaborative methods in science and engineering courses has been reported.

One of the reasons adduced to apply collaborative learning strategies is that professional engineers must interact with others professionals, requiring communication, leadership and teamwork skills that are not effectively instilled by traditional teaching techniques. But students have been acquiring social skills since they attended the kindergarten, and in professional life, teamwork is organized around specialized personnel with a clear hierarchy, whereas at the university students are forced to deal with potentially uncooperative members.

The experience this paper deals with, trying to avoid the drawbacks attributed to collaborative learning methods, was implemented in a Separation Processes course in parallel with the development of the common topics. The assignment was

the design of a chemical process plant based in a (part of a) real-world project for ETBE production. The students were organized in four groups (contractor companies) of five students, each one responsible of one of the five typical departments of an engineering company: project management, process design, mechanical design, instrumentation and piping. The project managers were the top students as by the qualifications of the first course tests.

The contractors received only the design basis specification and letters from the client (the professor) asking for the development of a stage of the plant design, usually affecting to only one department. At the department level, at every stage of the design the four groups competed and the best solution was adopted for all the groups, providing the same starting point for the evaluation of every department. Apart from the coordination function, project managers wrote an operations manual, and detailed the utilities supplies. They also collected and organized all the documents of the project.

The general idea behind the grade structure was to avoid the drawbacks of the collaborative learning methodology, as the usual conflicts in groups of students that, apart from trying to learn, have to deal with the negotiations in a team where the hierarchy is diffuse or inexistent. Grading included individual and group results. By letting the departments to grade the project manager and the project manager to grade the departments it was expected that a reciprocal sense of interdependency appeared, but it did not happen.

The projects were sent to a real world international contractor company for evaluation and their comments were very positive, mentioning an “almost” professional work. The key factor for the success seems to have been the work of the project managers. The winner group was the better only at two milestones, but the final project was significantly better than the others because of the coordination and involvement of the project manager.

The result of the experience was good at the technical level and was well accepted by the students, but not all the goals were attained: the control of uncooperative members by the project managers using the grade policy was insufficient, and the competitive part of the design, that in part was possibly stimulating for reaching so good results, was considered unfair by some students.

Introducing Project Management Theory into a Capstone Design Sequence

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Abstract— The capstone design sequence in the Electrical Engineering Program at Western Kentucky University is a two semester sequence. Student teams design and execute a solution to an industrial or applied research problem during the academic year. In order to improve the capstone sequence, project management techniques have been introduced into this sequence. These techniques include acquainting students with project management theory and teaching students to manage the projects more effectively. This paper will present the basic structure of the sequences, discuss the assessment results which led to this new focus in the sequences, describe the project management techniques incorporated into the courses, and explain the impact the new emphasis has had on the capstone design sequence.

Keywords- capstone design, senior project, project management

I. INTRODUCTION

The Electrical Engineering (EE) program within the Department of Engineering at Western Kentucky University (WKU) has a project rich curriculum. Our students take a design course each academic year that provide opportunities for completing projects. As the students mature through the curriculum the amount of work effort, design, and project size increases, until the capstone sequence of their senior year. As our student numbers have increased, the effort of managing these projects has become a difficult task for the EE faculty. To address these problems, the faculty of the EE program has utilized conventional project management techniques to create a design process to manage and assess the project teams for our senior capstone experience. The subsequent work describes the capstone design sequence our senior EE students complete. Next, the assessment data alluding to the difficulty in managing these projects is presented. In an effort to address these problems, the revitalized design process is presented with much detail. This work is completed with some concluding remarks. The utilization of this design process is new within our program. As the faculty assesses its performance in helping the student complete their projects there is room for adjustments so the process has the right balance of control and flexibility such that the students are successful.

II. DESIGN OF EE CAPSTONE DESIGN SEQUENCE

Students entering their final year of study in the EE program at WKU take a two semester capstone design

sequence comprised of EE 400 (EE Design IV) and EE 401 (EE Design Project). In these courses, students are placed on teams and assigned projects which include industrial and applied research projects. The students design and execute a solution to the design problem during the academic year. The courses must be taken sequentially in an academic year. The first course in the sequence is EE 400. During this course, students focus on design methodology and decision-making. The course includes ethics, professional issues, and the planning and design phase of the project culminating with oral and written reports. The objectives of this course are to further develop design skills, develop teamwork skills, learn to deal with situations in an ethical manner and write the senior project proposal.

The second course in this sequence is EE 401. This course is constructed so that the student design team will assume the primary responsibility for the completion of the project. At the end of this course, students have completed a major capstone design experience and can demonstrate their ability to design, build, and test a system to meet specified criteria. Also, students exhibit their capability to communicate their project design and results in a written format and in an oral presentation.

The design sequence has multiply opportunities for faculty to provide feedback to students regarding project progress. Mandatory status meetings occur weekly in which the design teams meet to update the faculty on the status of the project and deliverables. Prior to each progress meeting, the team must submit a status report. Also, several design reviews are scheduled for each team during the academic year. At the design reviews, the teams present the status of their project. During the design reviews, the faculty evaluates team progress toward the established project milestones. Failure to meet the milestones will affect the final grade.

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Information Technology in Logistics: Teaching Experiences, Infrastructure and Technologies

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Abstract—Information Technology has always been a popular choice among high-school graduates when deciding on a field of study. Despite the comparatively high education levels among Latvian employees, there is still a lack of knowledge and practical skills crucial for competitiveness in a market based economy. In order to ensure relevance of the qualifications and adaptability in the fast changing environment, active learning and teaching have a special importance. Recent developments in information technology call for a serious reconsideration of the actual teaching methods and provide opportunities for developing a new educational methodology. This paper focuses on experiences of application of information technologies within the course of Logistics Information Technology for developing students' practical skills and abilities. Experience shows, that social emotional skills and abilities of nowadays students have better response on interactive collaboration, especially on active methods of teaching. Therefore, the necessity for an active teaching and learning e-environment is highlighted, and its possible realisation with application of Web 2.0 technologies is discussed within the course of Logistics Information Technology.

Keywords—active teaching and learning, information technology, logistics information technology, web 2.0

SUMMARY

The symptoms of necessity for the course Logistics Information Technology (LIT) in the Master Curriculum on IT at Riga Technical University (RTU) were pointed out firstly during participation in the European Copernicus project AMCAI (1994 – 1997). The project's results demonstrated a great lack of logistics specialists having efficient knowledge in information technology. The course of LIT was developed for the post graduate students of the Department of Modelling and Simulation in 1998. The LIT course is aimed at providing students with high level knowledge, skills and competencies in Logistics IT through the integration of theory and practice. The course focuses on the application of information technologies to logistics management. The LIT course is taught basically for students having an average age of 22-24. Almost 90% of them are employed either in private companies or in government organizations, which makes them to be extremely high demanded for qualitative learning and teaching processes.

In LIT, the main focus now is on supporting students in active learning. By active learning we understand "instructional activities involving students doing things and thinking about

what they are doing". Laboratory exercises are a traditional method of active learning. Labs can be used to facilitate the exploration and illumination of difficult concepts. Most importantly, labs can enhance the cognitive learning process, which is referred to as the integration of theory with practice.

In fact, information technologies within LIT are not only the subject of teaching, but rather a part of didactical tool aimed at demonstrating the power of IT in every field of application, such as logistics, education, entertainment and others. The possibility to learn information technologies and systems by applying them in studies allows students (1) to understand the main principles of IT in Logistics (which is the aim of the course), and (2) to evaluate the variety of its applications for different solutions (which is the outcome of the course). This, according to Bloom's Taxonomy of Educational Objectives, can be explained as student growth through development of their intellectual skills and abilities.

Application of modern IT for teaching/learning purposes in LIT started firstly with using an on-line test as evaluation. Application of IT as an environment started in 2005, when all course materials were located at the Moodle system. In 2008, the web portal ORTUS was created as a single electronic educational environment of RTU. Despite plenty of benefits being provided by these solutions, there are still some shortcomings listed in the paper. They lead to the final conclusion concerning the necessity of re-designing the e-learning environment in order to satisfy the requirements for active learning. Recent developments in IT facilitate the development of new training and educational methods and tools. This provides possibilities for organizing educational processes not only in the traditional way, but also by means of active learning, combining IT with modern pedagogical approaches. The concept of Web 2.0 based e-teaching environment opens new horizons for active teaching, providing student with wider education possibilities in enhancing their professional skills and abilities. By using the Web 2.0-based LIT e-learning environment, both lecturers and students are able to create individual centers of teaching and research on the different themes of LIT. Moreover, the designed e-environment provides opportunities to form student personal portfolio achievements in studies and research, by submitting them in an electronic form for discussion and debriefing with co-students and lecturers.

Session: 10C Area 2: Virtual Worlds for Academic, Organizational, Life-long Learning and training - Virtual media and tools

Fingerprint Identification in LMS and its Empirical Analysis of Engineer Students' Views

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A Virtual Photovoltaic Power Systems Laboratory

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Lab2go - A Repository to Locate Educational Online Laboratories

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Fingerprint Identification in LMS and its Empirical Analysis of Engineer Students' Views

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Abstract—This paper describes a fingerprint identification system (FIS) developed to be integrated in learning management system (LMS). Hence, a middleware is necessary to connect any LMS with our own FIS, which will provide us a scalable, robust, easy integration in any LMS. This project aims to solve the problems of identity authentication of users in remote or virtual environments whose use has spread both in distance education and traditional universities. It seeks its integration into traditional and remote environments, and in the remote environment in exams as well as virtual labs. The project aims to cover all the weaknesses that traditionally have the password or user name. The implementation starts from the own fingerprint identification system developed to its final integration in the LMS.

Keywords—evaluation; fingerprint identification system; learning management system; middleware; virtual labs)

SUMMARY

Nowadays, there are many precise solutions for the security in physical access and even in processes online. Into the higher education is becoming a need using new security systems. Student cards with just barcode are not enough to assure the identity. In the same way, new virtual communities manage different courses, contents and tools such as: forum, chat, calendar, etc. but what refers to identification still uses user name and password to let enter to the system. Hence, it can see the necessity of developing new application that complement and intensify the learning management systems. Such systems do not guarantee the identity of the person. So, we need a solution for the identity of the people that access to Web applications.

Our university has made great changes, automating the entire evaluation process, leading to what we call “virtual package”. A barcode reader identifies students who access an examination room. After checking if the student is allowed to do an exam, it prints in real time a customized exam for that student, indicating the place in the classroom where the student must sit. The new assessment model aims to use the resources of educational communities and add a new identification module.

Therefore this new model instead of printing the test, the test will be done by computers in the examination room. The prints just only will indicate on a label where a student must sit. Every post will have a computer along with a USB biometric reader which will identify the student and then will show his test.

The access to a class in the LMS with open permissions is done by a user name and password, which are data that can be easily acquired by others. Which puts into discussion the resources and content that must be shared with this ambiguous security.

The new service stems from the challenge of ensuring that identification. In other words ensure that the person is really the person access to such rights. This is done for a double identification using the username and password along with a new biometric application that interacts with the LMS and contents such as web exams, virtual labs, and so on.

The learning management system offers range of services among which is the option to do tests. When a student accesses to the assessment package in LMS it will start the communication between the LMS and the biometric device on the user.

The communications interface in LMS will request the capture of a biometric sample. Then, the biometric interface will send a captured sample. The next step will be to communication between the LMS interface and the authentication server.

The captured sample will be verified in the database of the Authentication server. This database will contain all the samples of students with personal data, so that the biometric matching [1] will be 1:1 from a password.

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A Virtual Photovoltaic Power Systems Laboratory

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Abstract— This paper describes the design and implementation of a virtual laboratory for photovoltaic power systems based on the Cadence PSpice circuit simulator, which is intended to be a complement to the traditional physical laboratory in undergraduate photovoltaic engineering courses.

Keywords— component; photovoltaic power systems; laboratories; simulation; engineering education; spice;

SUMMARY

Virtual laboratories are recognized as an attractive complement to traditional engineering laboratories. Among other advantages, they do not require expensive and dedicated equipment, reduces the required time for instruction, and promote student involvement and learning [1]. This paper describes the design and implementation of a virtual laboratory for photovoltaic (PV) power systems based on the Cadence PSpice circuit simulator.

For this purpose, a PSpice symbol library of PV components, called Sisifo, has been constructed, which nowadays includes the following components: PV generators, ON/OFF charge regulators, lead-acid batteries and DC constant power loads. The current version of Sisifo allows the simulation of these individual components as well as stand-alone PV systems created with them.

The use of PSpice is very common in industry, research, and also for training and teaching electronics. Besides, despite PSpice is a circuit simulator, it has been also used for simulating other kind of systems. Its application for the simulation of PV systems begins in the nineties, and there is even a textbook on this field [2]. The simulation tool described here was former designed for research purposes, but it has been updated as educational software that can be integrated into PV systems engineering courses, which are every day more frequent in the university curricula.

As mentioned above, the virtual laboratory is intended to be a complement to hands-on experiments and can be used in supporting both pre-laboratory and post-laboratory assignments. Pre-lab exercises may provide theoretical background and preparation before performing hands-on experiment, and they can also be employed for identifying points of confusion or individual student problems. Post-lab tasks allow the repetition of hands-on experiments or performing those that are very difficult of making in the physical laboratory.

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Lab2go – a Repository to Locate Educational Online Laboratories

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Abstract—This paper discusses the creation of a common framework to describe online laboratories according to the semantic web technology. The so called Web 3.0 technology is actually growing daily and is proposed to be one of the leading Web technologies within the next years. Improved search mechanisms and facet based browsing are only some key features which enhance the data handling within the repository. Online laboratories are interactive experiments which are available over the Internet and can be divided into two main groups, software simulations and laboratories made up of real hardware equipment. Technology-enhanced learning is becoming a new important trend in higher education worldwide. In particular, engineering education is becoming an exciting emerging field of research because it involves a multitude of disciplines which aim to resolve the pedagogical problems that arise with the advancement of technology. With the help of the semantic web technology a significant step forward can be made in terms of a general description model for online laboratories and the location

Online Laboratory; Semantic Web; Ontology; Web Repository

THE ONLINE LABORATORY PORTAL

Online laboratories are interactive experiments that are provided over the Internet. Online laboratories can be divided into two main groups, software simulations and laboratories made up of real hardware equipment.

The main aim of the presented work is to implement a Web portal that works as a repository of online laboratories, offering a common framework to collect and describe laboratory data from different laboratory providers located all over the world. Such a platform turns out to be necessary to continually foster the development of laboratories and exchange of knowledge among interested parties. This Web Portal will host information about running research projects, researchers, organisations, existing state of the art technologies, etc, in order to strengthen the collaboration in this field of science as well as providing knowledge about the laboratories and their operating institutions.

This paper shows the fundamental problems that exist today and the requirements which are necessary to be considered. One objective of the platform is the improvement of the search process for online laboratories with the use of Semantic Web technologies. Due to the particular way used by the Semantic Web to describe resources, not only full-text search can be

supported. This kind of description enables new ways for the implementation of search mechanisms like facet based browsing which allows the user to search information according to the properties of a special object. Furthermore it is possible to query resources based on specific criteria.

One of the first steps to make use of the semantic web technology is to create a generalized, formal representation of the domain. This general model consists of various properties, data types and relationships representing various types of online laboratories in a generic model. To develop a model, which is accepted by the end users it is essential that the model is easy to understand, well structured and a very close representation of the real world situation. At this point several discussions about various general states have to be made to ensure that the model is really applicable to the current real-world-situation.

The semantic collaboration platform OntoWiki which was developed by the research group AKSW at InFAI (Universität Leipzig, Institut für Angewandte Informatik) was chosen. OntoWiki is an open-source Platform which can be installed by any Web space and accessed by an ordinary Web browser [2] and is easily adjustable by writing customized plug-ins. OntoWiki is the base for the portal and provides a framework for the development of Semantic Web application and was therefore used to create a customized solution for online laboratories. Mostly users are not familiar with the concepts of Semantic Web or are not willing to spend time writing the metadata manually. For that reasons Lab2go is also a tool to create metadata for the online laboratory resources.

Summarizing this paper shows an overview about the Semantic Web (Web 3.0) and the most important differences to Web 2.0. Furthermore it covers the problems of lack of information channels for online laboratories and presents a potential solution in the form of an online portal.

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Session: 10D Telefónica Special Session: Telefonica University Chairs

Telefónica University Chairs Network

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**LMS and Web 2.0 Tools for e-Learning: University of Deusto's
Experience. Taking Advantage of Both**

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**Attracting Student Vocations into Engineering Careers. EnginyCAT: Catalonia
Promotional and Prospective Plan**

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**The LULA Project by the Telefónica Chair of the University of Extremadura -
LULA Linux Distribution for Latin American Universities**

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Abstract—This panel session proposal describes an introduction of the technical activities carried out by some of the Telefonica University Chairs along Spain in a whole view of activities inside the social working of Telefonica and their associated chairs.

Keywords—*Technical networks, Corporative identity.*

ABSTRACT

Telefónica University Chairs Network focuses on the social impact of Information and Communication Technologies (ICT) in the public agenda issues and especially in some of the principal areas of interest for Society, such as: the impact of ICT in education, health, inclusion, climate change, security or productivity. In 2009, its strategic plan includes: research projects, prospective studies and surveillance technology, workshops with experts and knowledge transfer activities. Currently, there are 16 Telefónica University Chairs in 13 Spanish universities.

Under this programme, Telefónica has promoted a knowledge portal that aggregates information coming from

different universities sources belonging to the Chairs network. The objective is to create and develop a community of experts belonging to both, the academic and the business worlds with the aim of opening the conversation and disseminate the contributions to the community. In the website can be found, for example, information about the use of new technologies in education, advances in telemedicine, analysis about how to improve the industry productivity or how the use of ICT can help with climate change challenges.

Telefónica University Chairs Network provides a channel for knowledge transfer among universities and also between universities and Telefónica. Specialised workshops are periodically organized with the participation of business and university experts to discuss and share knowledge about the current state and the future of some strategic topics. Some of them are: the new architecture and the challenges of the next Internet generation, IPv6, intelligent sensors networks and security in electronic commerce.

More information: <http://www.catedras.telefonica.es/>

LMS and Web 2.0 Tools for e-Learning:

University of Deusto's Experience

Taking Advantage of Both

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Abstract—The experience of the University of Deusto in applying a Competence-Based Learning Model supported in an LMS and the results of the adoption of this Learning Model to a new Open Source LMS give us the lights of LMSs experience in University. The adoption of 2.0 technologies in the classroom through an initiative of the Telefonica Chair has result in a test bank and a useful experience for educators interested in applying these technologies.

Keywords—component; education; LMS; Web 2.0; Learning Cycle; Competences; e-Learnine.

SUMMARY

Information and Communication Technologies have enabled us to gather much more information, to process it better and to disseminate it to anybody in the world, but technologies, by themselves, will not give us a place in heaven.

The University of Deusto has been developing and implementing a unique pedagogical framework known by its acronym MAUD [1]. MAUD is based in autonomous and meaningful learning and centered in students' skills and competences development as advocated in the EHEA.

The development of a competence-based model found in ICT a natural ally allowing teachers and students bear part of their interaction and monitoring of their learning process in an Learning Management System platform. The aim of the project of adapting a new LMS to the MAUD was twofold. For one hand, University of Deusto took advantage of this process to rethink the whole tool and for the other, it was agreed that the new solution should be an Open Source.

Competences are the cornerstone of Deusto's pedagogical model. Twenty one competences comprise MAUD's framework, each of them split in three progressive levels of achievement and forever y level several indicators and descriptors have been established to offer a complete vision of students' performance.

So it was necessary to adapt the new LMS to MAUD's requirements. The result of this work has been a new platform

that has integrated the knowledge accumulated in a decade of research and experimentation in a competency-based model over an Open Source platform widespread.

At the same time, the popularity of Web 2.0 [2] has brought a slew of new interaction styles, boosting participation (collaboration), customization (flexibility) and immediacy (real-time). Such a radical shift has determined the development roadmap for the available LMSs but unfortunately, they are too lined up with the conventional education structure and they haven't been able to follow flexible 2.0 applications' fast pace.

Despite the successful experience of the University of Deusto in the use of an LMS as a tool in which support their learning methodology, the Chair of Telefónica, true to its goal of exploring the opportunities offered by new technologies applied to education, could not stop the implementation of 2.0 technology in the classroom.

After two years promoting them, we could conclude that using Web 2.0 applications at classroom has been a very positive experience not without difficulties. There is no specific solution for the problems, but different tools can be combined to achieve a good trade-off among.

ACKNOWLEDGMENT

The findings and conclusions presented are the result work of a team impulse by the Vice Rector for Innovation, Aurelio Villa, and the Institute of Educational Sciences. The support of the Telefónica Chair has allowed parts of this work to be carried out and news experiencing been developed nowadays in the adoption of new technologies into the classroom.

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Attracting Student Vocations into Engineering Careers

EnginyCAT: Catalonia Promotional and Prospective Plan

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Abstract—In the developed countries vocational demand for scientific and technical studies is a serious concern for government, universities and companies and different analysis and programs are promoted to try to compensate the steady decrease of their demand. In this communication the phenomena for Spain, with an spatial emphasis in Catalonia, will be reviewed in the European context, and some clues for promoting new engineering vocations will be given.

Keywords-component; engineering vocations, engineering studies promotion

SUMMARY

The Catalan Government concerned by the decreasing number for engineering vocations in the context of a foreseeable mid term increase on engineering graduates demand to sustain the so called knowledge-based society new challenges decided to promote a plan to foster engineering vocations in Catalonia, through the EnginyCAT initiative. Progress and output figures for high school and university have been analyzed and compared at international level and more significant insights on youngsters' vocations and clues for attracting vocations have been studied.

UPC-Telefonica Chair on Future Trends on Information Society focuses its activity on the analysis of the Information Society evolution and in its impact on the different significant social fields and in particular on education, health, administration and competitiveness. Special attention is devoted to the national and international best practices and indicators at both national and international levels. The research approach for the different fields is based on the analysis on the general trends at global level and its projection at local level based on specific regional studies that allow extracting robust indicators. One of the main topic consists on studying the evolution and future trends of the scientific and technical education at the different educational levels and more particularly in high education at both national and international perspective

EnginyCAT and the UPC-Telefonica Chair have joined efforts to study the main professional fields and factors for engineering practice are to draft the main professional tendencies. Basic trends for job market will be analyzed at international level and projected into the national and regional Spanish levels. Specific and differential parameters for the job market corresponding to the different main disciplines: civil, industrial and ICT, is a central field of research.

From an attentive analysis of the different academic and professional parameters it comes clearly the need to increase engineering attractiveness among youngsters. Science and technology proficiency will become of the leading economic development factors.

The key element is to generate a clear, positive and realist vision of the future engineering professional role. It is then necessary to interact with the k-18 pre-university kids and youngsters to let them know the new engineering challenges, (energy, water, health, environment, education, mobility, entertainment, aging people, etc), to increase the design and problem-solving component in our higher level studies, and to promote the innovation and entrepreneurship culture among our graduates to contribute too create a new generation of high-added-value companies able to hire very talented and motivated people.

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The LULA Project by the Telefónica Chair of the University of Extremadura

LULA Linux Distribution for Latin American Universities

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Abstract—Many universities use free software applications as tools for theoretical teaching and for resolving practical exercises. In many cases they are software packages in the development of which many users collaborate, in constant evolution and adaptable to different teaching needs. In Latin American universities there is a growing tendency to use it and there are communities highly committed to its development.

As an attempt to compile those applications most used in Latin American universities, the LULA Project (Linux para Universidades Latinoamericanas) is about favouring the integration of this software and the exchange of educational material amongst universities. It is a non-profit initiative coordinated by the Telefónica Chair of the University of Extremadura, in which the integrating universities of the Virtual Latin American Campus (CAVILA) collaborate.

Keywords—component; Educational software; LINUX Distribution; LULA Project.

SUMMARY

The idea of this project emerged from the cooperation of the Telefónica Chair of the UEx with AULA [1], an association of Latin American universities (the UEx among them) founded in 2007 and aimed at coordinating the creation of an ambit of higher education in which cooperation and the exchange of knowledge and experiences amongst public universities and research groups will be encouraged.

The LULA initiative is being coordinated by the Telefónica Chair of the university of Extremadura, with the help of those in charge of education and technology at the seven universities which are currently members of CAVILA: Federal University of Santa María (Brazil), University of Guadalajara (Mexico), the National University of Entre Rios (Argentina), the Nacional University of La Plata (Argentina), the University of Porto (Portugal) and the University of Santiago of Chile (Chile). The initial diffusion of the project was to those in charge of these universities, but the news extended over the internet to such an

extent that other universities and user groups have joined the initiative.

After the call on behalf of the Telefónica Chair to the rectors and other academics in charge of CAVILA universities for collaboration in diffusing the initiative, to date the LULA site has 140 registered users and almost a hundred requested applications during the first phase to be included in the distribution. The number of IP addresses that have visited the site is more than ten thousand.

It should be stressed that, since the beginning of the project, a spontaneous diffusion has been produced through news sites, forums and blogs principally related to Free Software. This has brought about interest in collaborating at other Latin American universities, groups of users and private users. In fact, more than half of registered users identify themselves as being from universities that do not belong to CAVILA.

A total of 95 applications were requested, amongst which predominate programming tools, mathematical applications, statistical analysis applications and general purpose applications related to office applications, multimedia and communications.

It is still early days to evaluate the results and repercussions of the Project; however, the involvement on the part of teaching staff is good and requests to collaborate are still being received to date. After the first experience, it is foreseen that in 2010 new services and resources in the LULA portal will be incorporated where universities and groups of users of applications or types of specific applications participate in the exchange of material, guides, and experiences, enriching their knowledge and, consequently, of future versions of LULA. For the next version of the distribution the setting up of the most common resources of collaboration in communities of free open code software, such as wikis, forges, mailing lists and, follow-up of task lists.

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**Session: 10E Area 5: Lifelong Learning and Nontraditional Students -
Practical experiences**

Experiences in Using Integrated Multimedia Streaming Services to Support E-Learning in Manufacturing Processes

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Influence of PBL Practical Classes in Microcontroller-Based Digital Systems Learning

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TICTAC: Information and Communication Technologies for Augmentative Communication Boards

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CEE Manuel López Navalón (Spain);Education Sciences Institute-USC (Spain);University of Vigo (Spain)

Integrating digital video resources in teaching e-learning engineering courses

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Experiences in Using Integrated Multimedia Streaming Services to Support E-Learning in Manufacturing Processes

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Abstract—Most E-Learning projects tend to separate learning activities from everyday work. This paper presents an approach where closer integration between learning and work is achieved by integrating multimedia services into manufacturing processes. In this paper we suggest to combine the areas of media streaming services and manufacturing processes, by providing electronic learning offerings as collections of media streaming services. The key components of our approach are 1) an xml based streaming service specification language, 2) automated configuration of distributed E-Learning streaming applications, 3) web services for searching, registration, and creation of E-Learning streaming services.

Keywords—just-in-time learning; media streaming services; web services; manufacturing processes

SUMMARY

Manufacturing processes involve the control and management of manufacturing systems ranging from basic assembly processes to the high-tech manufacture of pharmaceutical, telecommunications and electronic equipment. Categories for such manufacturing processes are assembly line / flow shop, and cellular manufacturing / group technology. E.g., in case of assembly line based processes a line of dissimilar machines are grouped in the line (sometimes more than one to balance flow). Innovation, productivity, flexibility, and continuous improvement are key ingredients to success in the constantly evolving world of manufacturing. What is actually needed is a learning “on demand”, embedded into work processes, responding to both requirements from the work situation and from employee interests, a form of learning crossing boundaries of e-learning and performance support.

The goal of E-Learning services integration in manufacturing processes is, through the development of new IT solutions, to accelerate and enhance the ability of manufacturing industry to capitalise on the emergence of a powerful global information infrastructure. Multimedia networking services support monitoring, controlling and supervising production processes in order to achieve high levels of efficiency and environmentally friendly production.

The new flexibility of workers and work environments makes traditional conceptions of training in advance, in rather large units and separate from work activities, more and more obsolete. The following streaming services can be identified:

- Pull (on demand) service: allows on demand access to remote E-Learning content.
- Push service: e.g. a push channel from a remote expert to the manufacturing personal
- Push service: for recording a failure scenario during a manufacturing process
- Conference service for maintenance and remote diagnosis

In Section 2, we introduce a model and a XML based language which allows specification of E-Learning streaming services in terms of media objects, roles, distribution and replication policies, quality of service aspects used for content delivery and related manufacturing resources. Our configuration approach is based on a clear separation of a streaming service specification, and its implementation by a distributed infrastructure.

In Section 3 we discuss realization aspects based on web services which we are investigating in the context of our prototypical system. We propose a set of web services for searching, registration, creation and management of streaming services. We also discuss our experience in using the implemented approach in a manufacturing process of a subcontractor to the automotive industry. Finally, in section 4 we offer some conclusions and directions for future study.

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Influence of PBL Practical Classes in Microcontroller-Based Digital Systems Learning

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Abstract— Sometimes practical classes are seen by students as a mere requirement without any interest and that needs to be fulfilled spending the minimum amount of time. As a consequence, the aim of practical classes is completely distorted. A solution to this problem is the well-known project-based learning approach (PBL). In this paper, the influence of practical classes, each one organized as a small PBL activity, is analyzed in the field of a microcontroller-based system design course.

Keywords- PBL, microcontroller, digital, practical

I. INTRODUCTION

Many times, practical classes are pushed into background by students. As a consequence, they do not take advantage of them totally and this affects not only their knowledge acquisition, but also very important skills such as collaborative work, task management, critical analysis, etc. In this paper, a possible solution using Project-Based Learning (PBL) is proposed and the results analyzed, emphasizing the close relation that exists between student dedication to PBL practical classes and the success in knowledge and skills acquisition [1].

II. METHOD DESCRIPTION

The proposed method is employed in an annual course that deals with microcontroller-based system design. With the proposed method, each practical class is organized as a small PBL activity. Students, working by pairs, design a microcontroller-based system that needs to meet the requirements stated by the teachers (e.g.: a hysteretic alarm, PWM-based motor control, thermometer with temperature record, etc.). Each of these classes is specially related to a lesson of the course (and to others in a more indirect way), with the aim of providing the student with the opportunity to put into practice what is explained in lecture classes.

When each project is finished, students explain their solution to teachers and also answer their questions, with the idea of promoting oral expression and public presentation. Also, they hand a project inform with a complete explanation and with the answers to a questionnaire.

The main objectives of the proposed method are mainly two. First, giving the students the opportunity of developing certain skills such as critical analysis and collaborative work and, second, helping them in understanding what is explained in lecture classes rather than memorizing it, which is a very common problem highlighted by Bologna process [2].

III. METHOD ANALYSIS AND RESULTS

For analyzing the proposed method, students filled up a test which showed that they significantly invested more time in practical classes if compared with the usual approach and that this time was more beneficial to them, something usually achieved by PBL.

Nevertheless, the most interesting results deal with the influence of this approach in knowledge assimilation. For each practical class, an average date of handling over was calculated taking into account the handling over date of all the students. Hence, it is possible to determine, for each student and for each class, his dedication degree as the difference between his date of handling over and the average date (a more detailed explanation would be included in the final paper). Fig. 1 shows the relation between dedication degree and the result obtained in final exam. As can be seen, students with a higher degree of dedication in practical classes obtained better results (26 marks above five, 8 below five and 9 student did not sit the exam) than the others (5 marks above five, 12 below five and 46 students did not sit the exam).

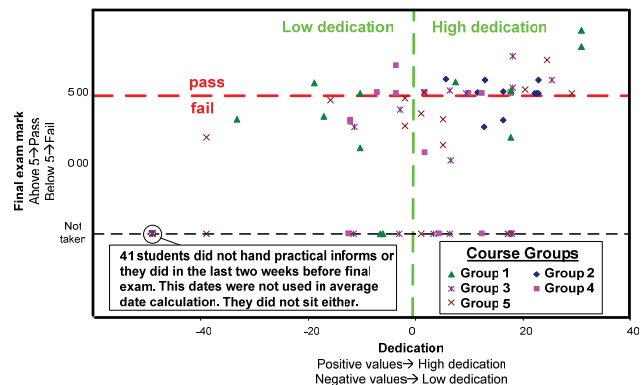


Figure 1. Relation between dedication and final exam results

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TICTAC

Information and Communication Technologies for Augmentative Communication Boards

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Abstract— Providing a communication aid is a complex issue which requires a deep insight on the theoretical backgrounds, the technological basis and, specially, the problems faced in bringing together the expectations and needs of users, teachers, speech therapists, families... and the perspectives and knowledge of linguists, teachers, engineers and speech pathologists. In this on-going project we intend to develop and implement helpful tools for students with communicative impairment by means of communication boards based on icons, pictures or conventional characters.

Keywords-Augmentative and Alternative Communication, Communication Boards, Special Needs, Accessibility

SUMMARY

We are aiming our research towards people with either temporary or permanent communication difficulties. These may come from a variety of etiologies and cause a wide range of problems, but include the need to use an alternative/augmentative communication system (AAC). Any effort in this field implies interdisciplinary work, besides the need to develop a tool powerful enough to assure communication but, at the same time, with a simple *front-end* which anybody with limited IT skills may set for daily use.

Speech therapists, psychologists, medical doctors, teachers, families... and those with a severe communication disorder, need to cope with the problem and manage a coordinated solution that gives the individual maximum autonomy, the highest degree of mainstreaming and inclusion in their everyday lives; a wide range of interactions and a minimum concern about technological issues.

A transdisciplinary group analyzed the *state of the art* and made a decision on the type of device to develop based on the following criteria: Economical:

- Communication is a human right and everybody should have access guaranteed.
- Functional: Easily customizable and reliable.

- Flexible: We are not looking for a tailored device but rather a tool any communication facilitator may use to meet the needs of the AAC users they are working with.
- Motivating: Intended to solve problems and be a help rather than being a *futility learned at school I'll never use outside*

In order to help people (particularly students) showing communication impairments, we are currently working on a set of two digital communication boards aiming two radically different problems. Both of them draw the limits of the issue according to the “ability to write” criterion. This ability should be assessed in “cognitive terms” rather than “motility terms”.

The first board has been completely developed as an icon/picture based board intended for AAC Systems in individuals without the ability to acquire a written code and has been previously discussed [1].

The second board has been developed and it is expected to be implemented and tested by pilot users by the second term of this academic year. It is intended for those physically impaired and thus, unable to hand-write or use an adapted keyboard but who are cognitively able to write. It consists of a virtual scanning keyboard optimized using cryptography algorithms activated through any standard or custom-made push-button.

This short-paper focuses on this virtual keyboard, showing the theoretical backgrounds and the technological basis of its development. Its main features have been presented and analyzed to give a glimpse of its functionalities and possible advantages.

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Integrating digital video resources in teaching e-learning engineering courses

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Abstract— In recent years, the possibilities for distance teaching in engineering education have increased tremendously. The widespread availability of the Internet has allowed the use of rich media over long distances. As visual connectivity improves, an opportunity to enrich and rethink the place of learning design in on-line and distance education is presenting itself.

The applications and potential benefits of the use of video in teaching and learning started with the analogue videotapes in the early seventies [1, 2]. In some cases, video technology was used to improve practical teaching by developing simulated laboratory sessions [3]. In others, video-taped lectures were used in distance courses as a substitute of traditional lectures [4]. Nowadays, with the broad use of digital technology, video can be considered as a powerful medium that, first, can provide narrative visualization, and second, can engage multiple senses of learners simultaneously. Educational applications incorporating videotapes, digital video and on-line video can be found in disciplines as diverse as management, language teaching, physics and mathematical sciences, medical education and engineering.

Traditional forms of educational video include film, broadcast television and video cassette playback. Analogue video disks allowed video resources to be integrated into computer-based learning, but this technology was relatively expensive and did not become widespread. With the advent of digital video, video resources can be distributed to students via CD-ROM or DVD, on-line via the Internet, and embedded within other computer-based learning resources. Compared to traditional forms of video which are viewed primarily in a linear sequence, digital video permits more effective interactivity and control, as video elements can be quickly selected by the user, or controlled by a computer program, in any desired sequence. Although, while the technical requirements for digital video production may now be less demanding, the production of quality learning content still requires appropriate expertise [5-7]

This paper presents a case study of development of digital video to be used in e-learning postgraduate engineering

courses. Videos should be used in autonomous DVD or embedded in hypermedia learning objects. Multilingual, interactive questionnaires and mixing use of animations and real images are some features of the video. The use of these video is put to the test in a postgraduate course on Solar Energy and other Renewable Energies in Buildings, within the framework of an international e-learning project. The pilot experience was designed to answer, amongst other, the question about what would be the students' usage during the course and what would be the implications of this experience for further developments.

Keywords: *Video teaching media, engineering education*

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**Session: 10F VISIR Special Session : VISIR Special Session: Practical
Workshop on VISIR electric and electronic remote labs**

Workshop on VISIR electrical and electronic remote lab: Practical view

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Session: 11A Area 4: Learning Models - Methods

Adaptive hypermedia systems for e-learning

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**Applying an Inductive Method to a New, Multidisciplinary, Management of
Innovation & Technology Course: Evidence from the University of Nicosia**

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**Implantation of a Methodology based on Standard Supplements applied in
Engineering Education**

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**yPBL methodology: a problem-based learning method applied to Software
Engineering**

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Adaptive hypermedia systems for e-learning

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Abstract— In this article we have studied the possibility of implementing traditional features of adaptive hypermedia in an open environment, and discussed the standards for describing learning objects and architectural models based on the use of ontologies as a prerequisite for such an adaptation.

Keywords: e-learning, learner modeling, , adaptive educational hypermedia, ontologies, RDF, IMS LIP

SUMMARY

E-learning is a very dynamic domain, constantly growing, which refers to educational content or learning experiences delivered or made through digital technologies. The development of this domain has a direct impact on teaching quality and reducing costs. E-learning today is dominated by Learning Management Systems (LMS).

The problem is that LMS does not offer personalized services, presents the same educational resources to different learners, regardless of different levels of knowledge, interest, motivation and objectives. Some of these differences are evident in the types of experiences that each person needs to learn.

Adaptive Educational Hypermedia Systems (AEHS) try to provide an alternative approach to non-individualized, providing various services, tailored to the learner profile. The purpose of this adaptation is to maximize the subjective satisfaction of the learner, the learning speed (efficiency) and assessment results (effectiveness).

In this paper we have studied the possibility of implementing traditional features of adaptive hypermedia in an open environment, and discussed the standards for describing learning objects and architectural models based on the use of ontologies as a prerequisite for such an adaptation.

We discussed how this information can be expressed as RDF Metadata and how we can use queries over this Metadata. We also discussed the architecture of our hypermedia all based on the Munich Reference Model. We finally present our system (adaptive hypermedia), which has been implemented as a prototype.

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Applying an Inductive Method to a New, Multidisciplinary, Technological Innovation Course: Evidence from the University of Nicosia

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Abstract—Technological innovation is one of the most important aspects of business for science students to learn. Academics and practitioners teach specializations such as MIS (Management Information Systems), Engineering and Science traditionally deductively: Students are introduced to theory and mathematical models and then are given exercises from the textbook and possibly some real-world cases/applications to analyze. A general observation is that teaching technology innovations to multidisciplinary classes generates questions on whether any real world cases could be explained; can any practical problem be solved; how does all this knowledge meet the needs and interests of a multidisciplinary class; is it really motivating to know that what they are learning will be useful for their curriculum and further for their careers? [1]; what about the course being introduced for the first time. Based on references [2] and [3] the most common reason for students to leave sciences is the lack of connecting the course material to the real world.

A student-centered approach where the student is responsible for his/her own learning by building his/her own version of reality is an alternative solution to such situations. Specifically a student-centered approach includes inductive teaching and learning where students are primarily presented to a precise challenge, like a real-world case study to analyze, seek a solution to a complex illustrated open-ended real-world problem or interpretation of experimental data. While dealing with these challenges students realize that they lack skills, knowledge, facts and conceptual understanding and they request the help of the lecturer, who plays the role of the facilitator. Based on references [4], [5] and [6] it is demonstrated that inductive methods encourage students to adopt a deep approach to learning that lead to further intellectual development. Inductive teaching and learning incorporates the following learning methods: inquiry, problem-based, project-based and discovery as well as case-based teaching and just-in-time teaching.

The current study examines and identifies issues arising from the application of an inductive method to the elective, new course MGT-370 Management of Innovation and Technology at the University of Nicosia. More specifically it reviews the unique features of the main inductive methods, concentrating on *inquiry learning, problem-based learning, project-based learning and case-based teaching* and describes their practical applications in the above mentioned course, through a case study design [7] through which qualitative data will be collected from the researcher,

lecturer of the course, for the Fall 2009 semester at the University of Nicosia. Further it discusses practical issues of implementation, specifically in meeting the needs of a multidisciplinary class. After one semester of this pilot study, interviews with the students as well as open discussions with the industry will take place in an attempt to get their reactions and record their experiences.

Recommendations are given to academics and practitioners who teach science courses, (multidisciplinary or not), and are interested in implementing one or more inductive methods, for: improving their teaching and learning processes, developing students' critical thinking and creative problem-solving skills, a deeper understanding for formation of positive attitudes and confidence in knowledge or skills toward strategic management of technology innovation [1].

Keywords-inductive methods; problem-based learning; technology innovations; student-centered approach; inductive teaching and learning method;

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Implantation of a Methodology based on Standard Supplements applied in Engineering Education

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Abstract— Presented work proposes a model for the integration of the normalization inside the technical teaching in the university context, taking into account the established requirements by the European Higher Education Area.

Keywords: *Standardization, EHEA, Engineering Education*

Actually, the use of standards and standardization field is lower than it could be desired in engineering education, perhaps its high interest in technical learning. For this reason, the main objective of this work is to develop and to introduce a methodology for the integration of standardization in technical education [1,2]. To obtain that the set of standards related is necessary to identify. This methodology is based in the development of a new typology of document named as “standard supplement” [3], by using the bases of the European Higher Education Area (EHEA)[4].

The proposed methodology serves to identify the set of “standard supplements” which are necessities in a specific subject, the knowledge, skills, abilities and attitudes to identify with the academic competences, previously defined, and a guide for the development of the contents of each “standard supplement”. The proposal structure of “standard supplement” is appropriate to different level of complexity.

As the document must be oriented to competences, a protocol of process is defined to include them. First step of the process will be to know the necessities of society in a specific field or scope to identify the professional profile required [5].

The result of this methodology is applied in a specific subject, specifically which studies the elements of Internal Combustion Engine (ICE), by developing the supplement for a connecting rod [3]. The analysis of functional requirements [6] provides the main characteristics of this element to help in the development of “standard supplement”.

In this work, a systematized model to solve the detected problems of lack of coordination and gaps in standards fields is

carried out, by the generation of a full body of structured and coherent supplements in ICE elements, but that could be used in others different cases.

Standardization, by means of “standard supplements”, could be used as a link between enterprises and engineering education.

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yPBL methodology: a problem-based learning method applied to Software Engineering

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Abstract— This paper proposes the yPBL learning methodology, based on the well-known PBL method and adapted to software engineering process by using the "y" methodology. The yPBL methodology is defined as a mapping between the roles and phases considered in PBL methodologies to the roles, iterations and phases considered in the "y" methodology. Moreover, the yPBL method includes different situations of active and passive learning roles not only for the students involved in a course but also for the instructors. Indeed, software engineering instructors face the same challenge of any software engineer and needs to continuously update their knowledge in software technologies. The yPBL method has been designed using the Unified Modeling Language (UML) and the various interactions points between the various process actors as well as the information to be exchanged during the synchronous and asynchronous learning process have been specified using this language. Finally, interesting preliminary results of the experience of using this methodology in the INSA of Toulouse are included in this paper.

Keywords-software development process, problem based learning, unified modeling language, software engineering process

SUMMARY

Software engineering is a complex process demanding from development team members a high level of knowledge and experience in diverse areas going from project management skills to communication, design and implementation expertise. Moreover, the large diversity of software design and development approaches as well as the accelerated development of new software technologies requires a continuous learning process. This is not only the case for software engineers but also for academic instructors teaching software design and development courses.

Problem based learning (PBL) methods have been successfully used in different domains and its benefits have been largely demonstrated [1,2]. These methodologies ask for the active participation of the students within the learning process, playing not only the traditional passive learning role but also an active role where part of the knowledge needs to be discovered and applied by themselves. Moreover, the students may be asked to transmit the knowledge they have acquired to other students in order to reinforce the learning process as well as to demonstrate that the learning objectives have been achieved. Nevertheless, even if PBL methodologies have been designed to be easily adapted to any educational domain, the specificities of software engineering courses need to be carefully studied in order to improve the benefits of these learning methods while applying good practice approaches that

are specific to this domain. As previously introduced, software engineering courses ask for multiple skills expertise acquisition and development. Indeed, students need to efficiently exert in the area of project planning, quality assurance, translation and traceability of customer requirements, analysis of the software context and constraints, mapping of functional and non-functional requirements to technical requirements, design of software solutions following good and well-known practices (e.g. design patterns or object oriented approaches), implementation of the designed solution, testing techniques, integration procedures and finally deployment and maintenance strategies of the software product and related documentation. The previous list is not exhaustive and shows the degree of complexity involved in designing PBL-based courses allowing students to play the required roles in order to achieve the software engineering learning objectives.

In the area of software engineering process, several methodologies have been proposed in order to efficiently support members of development teams to design and implement software products. Unified Process (UP) methodologies are very well known in the world of software engineering for providing an efficient process based on an incremental and iterative sequence of phases. Phases include analysis and specification of requirements, design and specification of the software solution and implementation, test, integration and deployment of the software product. These phases are planned and executed in incremental iterations where in each increment new customer requirements can be added within the process. Likewise, bugs detection and corrections as well as requirements change requests can be added in each iteration. As agreed in the software management plan, stable or experimental software products can be released at the end of the iterations.

UP methodologies have been specialized in the form of extended methodologies (i.e. Rational Unified Process, Enterprise Unified Process, Extreme Unified Process, Agile Unified Process, etc.). In recent years an interesting specialization known under the name of Two Tracks Unified Process (2TUP) has been proposed to face the reality of continuous changes of requirements and technologies that represents an invariant reality in software engineering. This methodology, also known as the "y" methodology due to its graphical representation, proposes a differentiation of 2 tracks for the Unified Process, the first (left) track represents the functional aspects of the software product and the second (right) track the technical aspects (e.g. technology, environment, platforms). This separation helps software

engineers to concentrate on discovering and specifying the functional requirements that need to be satisfied (left track) while allowing them to explore and select the technologies that could be used to build the software solutions (right track). Once the functional and technical requirements have been identified and specified, both functional and technical tracks can be merged in order to produce the software design specification. From this point, the software product can be developed, tested, integrated and deployed. This sequence of parallel and serialized phases will be executed within the incremental and iterative process proposed by the UP method. Benefits of this interesting methodology have been demonstrated by its application in many industrial and research software projects.

This paper proposes a new learning methodology, based on the well-known PBL method and adapted to software engineering processes. This methodology called yPBL is aimed at being applied to develop software engineering courses within the context of real software projects. yPBL is defined as a mapping between the roles and phases considered in PBL methods into the roles, iterations and phases considered in the "y" process. The yPBL method defines a process where incremental and iterative phases and communication channels and deliverables are planned and defined to facilitate the interaction between external and internal actors involved in the real software project: "the client" and "the project team". Within the project team, students and instructors work together playing different roles in order to build the software solution required by the client. Guided by a real project, internal actors of the process are naturally involved in situations of passive and active learning. Indeed, similar to the students, software engineering instructors face the same challenge of any software engineer face to the accelerated software engineering evolution. For this reason, both instructors and students need to participate in a continuous learning process. The yPBL methodology also defines an internal process where the interactions between the internal actors are planned in incremental iterative asynchronous basis. In order to perform these interactions, internal actors need to work on learning

activities including bibliographic research, course preparation and presentation and evaluation of peers based on real knowledge acquisition. Further in the software building process, internal actors need to apply their acquired knowledge in constructing the software solution. At the end of each planned iteration, interactions with the external actors (i.e. clients) are carried out in order to present and evaluate the product releases. During these interactions, the evaluation of the software product is done based on the client's satisfaction degree and the product qualities.

The yPBL method has been designed using the Unified Modeling Language (UML) and the various interactions points between the various process actors as well as the information to be exchanged during the learning, software construction and evaluation process have been specified using this language. The UML model of yPBL specifies the use cases driving the methodology as well as the various internal activities guiding the process. Furthermore, this model specifies the relationship between the roles and phases considered in PBL methods and the roles, iterations and phases considered in the Two Tracks Unified Process (2TUP) or "y" methodology.

A case study illustrating how this methodology has been instantiated at the INSA of Toulouse for Service Oriented Architecture courses is also presented. The obtained results are very promising and allow us to measure the advantages offered by the yPBL methodology.

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Session: 11B Area 3: General Issues in Engineering Education - Theories and studies about learning layouts

A Systems Theory Perspective of Electronics in Engineering Education

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Implementing new learning methodologies in the Hard Sciences: a cross curricular study of students' and professors acceptance

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Attracting, Retaining, and Preparing a Diverse Academic Engineering Workforce

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A Systems Theory Perspective of Electronics in Engineering Education

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Abstract—We briefly review fundamental concepts related to systems theory and systems engineering. We also review and structure a list of important properties for an electronic system and paradigms and techniques applicable to analysis and design. Then we present two specific case studies, in which the systems theory approach to electronics engineering teaching and research has been very influential.

Keywords: *systems theory; systems engineering; electronics systems engineering; model-based systems engineering; requirements; requirement-driven engineering; validation; verification; systems engineering education; electronics engineering education*

ABSTRACT

Electronics is currently a pervasive technology which is applied in all fields of human activity. It covers areas of application that span from human implants to offshore wind energy plants. Examples in each field of human activity can be given. A modern means of transport (train, bus, car, or plane), can include dozens of electronic devices, electronic control units (ECUs), power converters, and small signal sensors connected by communication buses and networks. Today's electricity network will evolve towards a smart grid in which intelligent electronic power converters will work in collaboration, communicating and synchronizing with each other to respond to the challenges that distributed generation and power efficiency are posing [1][2].

In addition, we cannot overlook the impact of globalization. Offshoring and outsourcing is spreading globally in all economic sectors, but is especially prevalent in electronics, where even R&D activities are being outsourced. Electronic systems must often be assembled from COTS (Commercial Off The Shelf) electronic subsystems and components, which may be manufactured half way around the world.

Important and critical systems depend on electronics; the failure of such systems can cause major economic losses and even put human lives in danger. Electronics engineers have to design and deploy reliable and robust systems using an intrinsically fragile technology, sensitive to temperature, radiation and environmental conditions. They have to create systems so complex that, sometimes, the human mind's capacity for abstraction and analysis is put to the test, due to

the multiple technological aspects, innumerable interfaces and relations between components, the intricacy of embedded software, and the functionality involved [3].

We briefly review fundamental concepts related to systems theory and systems engineering [4][5]. We also review and structure a list of important properties for an electronic system and paradigms and techniques applicable to analysis and design [6][7]. Then we present two specific case studies, in which the systems theory approach to electronics engineering teaching and research has been very influential.

Electronic engineering education has to cover multiple, specialized details which are, of course, necessary to prepare specialists. But we assert that an approach to electronics from the systems theory perspective should also be transmitted and emphasized in engineering education, giving future professionals a solid basis with which to tackle projects and developments involving the integration of complex systems. We review here some of the aspects and perspectives applicable to that end. Some of those concepts could be briefly included in an electronics course for non-specialist engineers, in order to give them the basis for easy communication and collaboration with electronics specialists.

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Implementing new learning methodologies in the Hard Sciences

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Abstract—*In this paper has been carried out a study to implement active methodologies using ITC to improve student's interdisciplinary competencies. Differences among three degrees students are analyzed and their opinions and results are present. We can find also professors reflections about their learning process.*

Keywords*New learning methodologies implementation, continuous evaluation, students' satisfaction, competences and quality.*

SUMMARY

Today's society is undergoing constant changes and this is reflected in the way the working world is structured. Not to mention, such pattern should play an important role in the university curricula since there is an increasing need of qualified professionals who will have to face such challenging changes and will have to prove, hence, their effective competences' training besides from an efficient skill in the Information and Communication Technologies (ICTs)[1][2].

In this sense, the 21st Century University should be able to offer its students suitable learning tools to become successful professionals of such a dynamic working world. Among other abilities, university students should become competent autonomous learners and it is with this goal in mind that the Tunning Project [3] aims at implementing active methodologies in the classroom by enhancing content learning and competence acquisition simultaneously and, very often, through the use of the ICTs, among other methodological tools.

Therefore, in this paper we include a comparative study of the efficiency of new learning methodologies implementation in a wide range of subjects from different degrees, which, at the

same time, belong to different academic cycles at university. Besides, we have also focused on the role of the ICTs as a main piece in the learning process. Our main objective, then, is to assess whether these methodologies [4] and tools are suitable for technical subjects with different contents and from such varied curricula as: Environmental Sciences, Industrial Engineering and Civil Engineering. Finally, in a second stage of this study, we have carried out some research on professors' willingness to incorporate active methodologies [5] in their classrooms and their degree of satisfaction and problems found when doing so in terms of learning/teaching quality improvement.

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Attracting, Retaining and Preparing a Diverse Academic Engineering Workforce

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Abstract— The National Science Foundation has recognized that the Nation's need for a technical workforce is in conflict with the changing demographics facing the nation. Our nation is rapidly becoming more diverse due to growth in groups that have traditionally been underrepresented in technical fields. Nowhere is this underrepresentation more evident than in academia. It was determined that one potential way to attract more underrepresented students to pursue engineering careers was to increase the diversity of the engineering faculty, proving powerful role models to potential technical students. Therefore, over 10 years ago, NSF began a program that sought to diversify

the Nation's faculty in engineering, science and mathematics fields, called the Alliances for Graduate Education and the Professoriate (AGEP). The AGEP Program is now a national network of multi-institution alliances. Nationally, the AGEP program has recorded significant gains in PhD degrees awarded to underrepresented minorities in engineering. The Southeast AGEP (SEAGEP) Program includes the University of Florida, Clemson University, and the University of South Carolina and is the top producer of Hispanic PhDs in the country and is third in the production of African American PhDs in engineering. Best practices in recruiting, retention, and preparation for the professoriate are detailed. illustrated by the portions given in this document. (Abstract)

Keywords-component; retention, professional development, engineering faculty, diversity

SUMMARY

Changing demographics in countries across the globe are changing the face of science and engineering. Institutions of higher education are being challenged to recruit and retain a diverse group of students and to prepare these students for academic positions. A model program developed in the United States is the National Science Foundation Alliances for Graduate Education and the Professoriate (AGEP) Program. A network of over 80 institutions has implemented programming specifically targeted to students from populations traditionally underrepresented in science and engineering professions. Key components of these programs are targeted recruiting strategies, professional development seminars, travel funding to attend professional meetings, and mentoring. Together these Alliances produce over half of the underrepresented minority PhDs in science and engineering, demonstrating the efficacy of targeted programming to meet the needs of a specific group of advanced students.

AGEP programs are data driven, for in order to identify potential obstacles to full participation of diverse students, administrators must know who is applying, being accepted, choosing to enroll, progressing through the program, and finally who is receiving the PhD. Annual data collection is necessary to document changes over time at schools that participate in these Alliances. In addition to this quantitative data, qualitative data collection gives administrators a richer picture of the graduate school experience of these students and can help guide the development of additional programming to assist these students. Finally, in order for the achievements of these programs to be sustained and to be institutionalized support from the highest levels of the Institution's administration is required.

The South East Alliance for Graduate Education and the Professoriate Program is a typical example of one such Alliance. The Alliance includes the University of Florida, The University of South Carolina, and Clemson University. Data collected by this Alliance show growth in enrollments and PhDs awarded in science and engineering to underrepresented students. Qualitative evaluation indicates that students highly value the peer support and mentoring that the program offers. The program also has provided financial support for students, including support during the dissertation writing phase. A unique component of the program is support for international research. In today's global environment, the opportunity to conduct research internationally is often critical to a researcher's preparation, and this program has supported students studying bird migration in Brazil, plants in Costa Rica, and soil erosion in Columbia.

From Canada to Kenya to Australia, Universities are experiencing greater heterogeneity of student populations. Programming and policy decisions can enhance or create obstacles to the full inclusion of all groups in the science and engineering enterprise. The AGEP program developed in the United States is one model that has been demonstrated to be successful at increasing diversity in the participating institutions. A data-driven, comprehensive program that identifies problem areas and monitors interventions can help an institution meet the challenges that changing demographics pose.

Session: 11C Area 2: Design Experiences - Tools and procedures

Design lab work in telecom

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Deep Drawing Tool for E-learning

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A review of electronic engineering design free software tools

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Design of an Educational Oscilloscope

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Design lab work in telecom

Definition, design and test of a wireless sensor network

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Abstract— This paper describes a teaching experiment where Master 2 students have to design a telecom system based on a wireless sensor network. Priority is given to an experimental hands-on approach.

Keywords—Telecom networks, Architecture and Protocol, Tests

I. INTRODUCTION

The field considered here is that of Wireless Sensor Networks (WSN). Various issues can be considered during a lecture on WSN [1]: electronic design, risk for the human being, management of the energy, technologies of telecommunication, signaling and communication protocols... The education experiment described in this paper essentially aims at making future graduates to acquire the basic knowledge needed to choose between several software and hardware architectures adapted to a given context, and to help them to evaluate the impacts of their choices on the protocols associated with the communication service. This teaching is based on self learning through the realization of experimentation platform which integrates different modules of telecom usually used in WSN. The students have to implement their communication protocols between the sensors and a distant user and use the platform to test them.

II. IMPLEMENTATION

A. Application Description

The students have to develop an application of a wireless sensor network. The aim of this application is the monitoring of a remote industrial site. This network is composed of sensors equipped with a telecom device, telecom gateways and a main station used to maintain communication with a user outside the site. Several buildings can be inter-connected with the same network. Three types of sensors are used. Each one has to transmit data which are different by their nature, their criticality and their periodicity. The requirements in telecom are thus varied, that will guide the choice of a telecom device technology and of communication protocols.

B. Telecommunication devices

Three different telecom modules are retained for this lab work: a 433MHz FM transceiver, an IEEE 802.15.4 device [2]

and a GSM/GPRS module, each one offering specific communication services. The FM transceiver simply offers an access to the medium whereas the 802.15.4 module offers more advanced communication services. The GSM/GPRS module gives access to all the services of a mobile phone.

C. Student expected approach

Students have to process several protocol tests on the platform they deploy in the goal of formulating generic principles on the WSN: choice of a telecom module and implementation of suitable communication protocols according to a targeted application. Students are given the application requirements. Then, they separately discover the property telecom devices in the framework of simple independent test cases. To do that, software development tools, sensors, microcontroller demo boards and telecom modules with their detailed datasheet are available.

Gradually, they extend test cases to emulate the complete monitoring application by integrating devices on a platform whose technological solution is represented on Fig. 1.

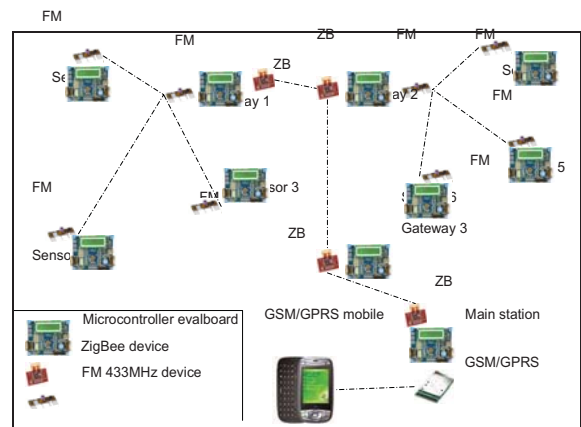


Figure 1. Example of a wireless sensor network

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Deep Drawing Tool for E-learning

A didactic approach for manufacturing engineering education

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Abstract— Manufacturing processes are an important element in industrial engineering education. In distance education, the learning of engineering subjects has a special difficulty, which can be reduced by means the use of new technologies, and the practice of mixed models of learning [1]. One of these processes is the deep drawing due to its relevance in the industry [2]. This paper presents a deep drawing tool for e-learning. The tool has been realized for its use in Master degree because it requires advanced knowledge in manufacturing processes. The tool has developed with the objective of the students can: a) Select input data for get the formability of material to deep drawing; b) Select the process that provide the best solution from a technological perspective; c) Optimize the process for saving the material; d) Know the influence of the punch in the results; e) Considerer the process cost.

The structure of the system has three subsystems: a) Solve, module for data processing and the generation of results; b) Materials, module for management data of the system; and c) Interface, module for user interaction. The tool has been implemented in software tool programming, developed in Java. This language has been selected because it provides a

methodology of object-oriented programming and its execution is possible in multiple operating systems.

This instrument of learning has been implemented in software tool programming, developed in Java. This language has been selected because it provides a methodology of object-oriented programming and its execution is possible in multiple operating systems. The paper describes each step of the tool, from the input data to final analysis (the steps can be seen in dialog box of Fig. 1) and they are showed through of the results given by the tool.

Keywords-component; engineering education; manufacturing; manufacturing data processing; manufacturing planning; computer aided engineering

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Figure 1. Startup screen

A review of electronic engineering design free software tools

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Abstract— In this paper we review electronic design free software tools. We have searched open source programs that help in several steps of the electronic design flow: analog and digital simulation, schematic capture, printed circuit board design and hardware description language compilation and simulation. Using some rapid criteria for verifying their availability, we have selected some of them which are worth working with. This work intends to perform a deeper analysis of free software tools and select some of them to use in education or in professional electronic design.

Keywords- *electronic design; free software; quality; evaluation.*

INTRODUCTION

Free software allows the user to modify the program and adapt it for his needs [1]. There are many examples of programs widely used and accepted: the gcc compiler, the Mozilla web browser, the Octave language for numerical computation, the GNU/Linux operating system and its adaptation to embedded systems, etc. However, not all free software programs have reached a high quality level and open source repositories show many abandoned projects.

The long term goal of the present work is to evaluate the situation of free software tools for electronic design and to select some of them for education or professional use. In this paper, we present a first review of such tools and perform a preliminary selection.

SEARCH FOR FREE SOFTWARE TOOLS

A. Topics selected

We have searched tools that are related to the following tasks: Analog and digital simulation, Schematic capture, Printed Circuit Board (PCB) Design, Hardware Description Language (HDL) compilation and simulation.

B. Sources of information

We have searched in FSF [1], in classical repositories [2] and through the Internet using the Google Web search engine. Examples of keywords used are Electronic Design Automation (EDA), electrical, electronic, HDL, PCB, etc.

RAPID PROGRAM TEST

We have performed a rapid test from the point of view of an electronic designer, which is not always familiar with free software tools. The test is based in five questions:

- Is there a stable version?
- Can it be easily downloaded and installed?
- Is the learnability good?
- Can it run a simple example?
- Is it likely to be maintained in the future?

In Table I we show a summary of the number of programs found and the number of programs we have considered for a future work. In the “analog simulation” item we have included not only simulation engines but also schematic programs that output netlist for simulation and programs that help to plot the results. In the “HDL” item we have included compilation and simulation programs as well as waveform viewers.

TABLE I. SUMMARY OF NUMBER OF PROGRAMS FOUND

Item	Programs found	Programs selected
Analog simulation	24	7
Digital simulation	13	3
Schematic capture	22	4
PCB design	12	3
HDL	28	8

CONCLUSIONS

On the positive side, we have found that there are free software tools that cover all the electronic design processes considered. On the negative side, there are many abandoned projects and information is generally a weak point, thus inducing confusion in the beginner.

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Design of an Educational Oscilloscope

A Hands-On Learning Tool

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Abstract— Paradoxically, most engineering students do not possess an in-depth knowledge on how an oscilloscope works. Automation is partly to be blamed for this problem. In fact, the existence of the “auto scale” button has eliminated the hassle of making adjustments, but at the price of dampening the students’ curiosity and removing their need for deep understanding.

We have found a powerful way of stimulating students’ curiosity and of bestowing them with knowledge of the basic oscilloscope operation: While still using an oscilloscope-set, although merely as a display unit, we have by-passed its fundamental components (namely the vertical amplifier, the time base and the trigger circuit), with our own designed components, built outside of the oscilloscope-set. Our teaching strategy provides students with hands-on experimentation of the circuits that control vertical gain, the time scale and the trigger level. Our educational tool is *implemented in hardware*; it is not another simulation oscilloscope.

The effects of our didactic tool are highly positive, as demonstrated by student evaluation of circuit laboratories that took place before and after we incorporated the Educational Oscilloscope into the engineering curriculum. This paper provides the reader with the following educational facilities: the Educational Oscilloscope circuit schematics, as well as the explanation of its several components as provided to the engineering students at SUNY New Paltz.

Keywords-component; design; education; oscilloscope.

Session: 11D Area 1: Computer and Web based Software - Security and Data Bases

Database Teaching tools

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Management and Optimal Distribution of Large Student Numbers

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Enhancing Database Querying Skills by Choosing a More Appropriate Interface

Drlik, Martin;Hvorecky, Jozef;Munk, Michal

Constantine the Philosopher University in Nitra (Slovakia);Vysoká škola manažmentu (Slovakia);City University of Seattle (United States of America)

State-of-the-art simulation systems for information security education, training and awareness

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Database teaching Tools

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SUMMARY

Database teaching involves explaining many ideas that are new to the student not just as being new material but new in the concept of the ideas. The question that students sometimes ask themselves so what is different about relational databases as opposed to any other form of database. The tools outlined in the paper are designed to show how a relational database is constructed from principles that allow the database to be reliable. The tools progress from the initial idea how a database is built from a number of tables and how the tables are related to each other to showing how data can be retrieved.

A. Entity-Relationship diagrams

These diagrams are the basis of relational databases and they show how various tables are organised to present a complete database. The tool allows students to compose a relationship between two entities based on the premise that there can single of multiple relations between two entities and that relations can be mandatory or optional. Not all variations can be represented by a simple relationship and the tool directs students to identify combinations that require a Relation for Relationship and how to formulate them.

B. Entity-Relationships and Tables

If tables of data exist that are to be used in a database it is necessary to make certain that the tables can be represented as relationships. The presentation of two sets of tables that may or not be directly related is the purpose of this tool. The student chooses the tables from an existing database and examines the occurrence of entries within each table in order to be able decide on the appropriate relationship. When a student has made a choice between mandatory/optional participation and multiple/single occurrences the tool informs the student whether their choice is correct. An incorrect choice will result in being asked to amend their choice but this time a little assistance is given in that the data is now compacted so that only what is perceived to be the primary key and its degree of occurrence is presented to the student. Realising that the tables and the relationships are different ways of presenting the same information is important in the context of relational databases

C. Functional Dependency

When designing a relational database it is important that the tables are constructed so that updating and modifying databases does not result in errors within the database. Tables

that have some functional dependency within them can give rise to such errors. This tool allows student to nominate various columns of a database as determinants and for these to be tested to see whether there is any functional dependency between them and other columns of the table. Clearly there has to one determinant that has functional dependency between itself and all the other columns. The tool will show this given that the student explores enough possibilities.

D. Normalisation

This tool depends upon the idea of functional dependency being understood and allows a student to split a table into a number of separate tables so that there is no functional dependency within table except that with the primary key of the sub-table. The test of any such sub-division is to be able to recombine the sub-tables to form the original table. The result can be surprising to a student when rows appear that were not in the original table.

E. Structured Query Language(SQL)

The use of SQL is where data is recovered from a database according to a particular request. Learning how to formulate a correct query can be helped by this tool as every stage of the processing by the database is shown. Queries can be part of a file of prepared queries or can be set in by the student relative to a selected database.

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Management and Optimal Distribution of Large Student Numbers

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Abstract— In principle, timetabling problems appear at every school and university. However, the degree of difficulty increases dramatically with an increasing number of students and courses for which the scheduling shall be carried out. From the mathematical point of view this is a “hard” problem, since the runtime on a computer cannot be estimated by a simple law (i.e. by a polynomial law) by the number of parameters. These kinds of problems are called “NP hard”. There are three important versions of the timetabling problem at universities, known as the university timetabling problem, i.e. curriculum-based course timetabling, post-enrollment timetabling and examination timetabling.

All specified problems are important for room management at universities, for the realization of courses that can be studied according to curricula, and for the satisfaction of students and teachers. These problems are related to the optimization of room management and personnel costs (e.g. by a uniform distribution of students). Thus, the solution to these problems is related to the optimization of “real” costs, a more and more important economic factor at (German) universities. Introduction of the two-tiered Bachelor and Master courses has raised awareness for these problems at German universities: due to the multitude of new courses the timetables which have been established and stood the test of time cannot be used any longer. Moreover classes tend to be more structured and have strong similarities to classical school situations; attendance is compulsory and dependencies between modules determine the feasibility of the curricula. This feasibility is also evaluated while accrediting new study courses. Since 2003, we have been using an algorithm that has been realized by members of our team for the solution of the post-enrollment-based course timetabling problem at the Technische Universität Berlin.

For classes with more than 2000 enrolled students, organization by itself is a challenge; problems may include splitting of those classes into several separate lectures, arranging the associated tutorials into small groups of students, allocating adequate rooms, and scheduling examinations. Moreover, homework and exams need to be administered, whereby, depending on the field of study, very different rules are to be obeyed. This especially pertains to the Department of Mathematics because it offers most of the compulsory classes in mathematics for all fields of study held at Technische Universität Berlin. These are the biggest

classes at the university and are to be attended by the majority of students. Thus, the Moses (Mobile Services for Students)-Account has been being developed and used since 2004. This web-based software allows students to enroll in tutorials with a list of preferences for given dates. A special algorithm, providing a globally optimized (with respect to the students’ wishes and resources available) solution, processes all registrations.

Keywords—university timetabling, academic administration, integer programming, NP-completeness

SUMMARY & OUTLOOK

We have been developing the software MosesKonto which solves the post-enrollment timetabling problem (for details see [1]) at TU Berlin with more than 17.000 spots in the 50 biggest courses. The problem is formulated as a constrained minimum-cost-flow network problem. Mathematically, a resulting integer linear program (for details see [2]) has to be solved.

The rapidly increasing number of courses using our tool motivated our group to develop more software solutions for different timetabling problems. We have recently finished the implementation of a tool which creates examination timetables for a huge number of written exams affirming that the students have enough time for preparation between two exams [3]. We also solved the university timetabling problem for TU Berlin (see [4]). This may be integrated into our software in the future.

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Enhancing Database Querying Skills by Choosing a More Appropriate Interface

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I. SUMMARY

A. Problem Statement

The amount of data stored in database systems is constantly growing. The number of their users also grows. To benefit from them, they should be capable of posing tasks that are solvable within the given database, formulate relevant queries, and interpret the obtained results. The user interface should allow them to concentrate on the core of the problem without disturbances caused by details of the query language's syntax. The aim of our research is to state which interface fits better for this purpose.

B. Purpose of Study

Despite the fact that SQL is a standard for database management systems, many of them introduce a version of Query-By-Example (QBE) language. Their developers likely believe that for non-professionals this sort of interface is more appropriate than SQL. Our review of literature shows that the topic was hardly studied in depth as a frontier field between design of query languages, computer-human interface, as well as users' mental and conceptual models. To do so, we designed and developed an educational methodology which (to our best knowledge) reflects them.

C. Research Method

The relationship between the interface offered by two query languages (SQL and QBE) has been investigated. We developed a methodology targeting introductory database courses for ICT non-professionals. Its first version has been designed, applied and tested in classrooms. Three hypotheses were specified; an experiment addressing the user's ability to express their requests in a correct and comfortable manner using a test group and a control group was performed. Based on its results, we are going to make another stepwise improvement of our methodology.

D. Findings and Results

Our first hypothesis stated that the students applying QBE-based approach will need shorter time for query formation. It has been proved.

The second hypothesis stated that the QBE students will create more accurate queries than those using SQL. This hypothesis was not confirmed. The quality of students' queries was identical in both groups. A more detailed analysis of the outcomes showed a quite opposite statement. If there would be a time limit on the query creation, the SQL group would create a larger number of accurate queries. This conclusion was achieved by comparing the time necessary for forming the correct answers.

The third hypothesis presumed that the QBE students will feel better comfort during their query creation and higher satisfaction with their results. This hypothesis has been confirmed.

Other interesting results have been generated by ANOVA repeated measures. They helped us to show statistically significant differences between combinations of variables (time, accuracy, and satisfaction) and the level of task difficulty. In accordance to them, the QBE graphic interface allows faster and more comfortable writing of low and medium difficulty tasks than the SQL text-based environment does. (The accuracy of queries remains comparable.) The result may have a positive influence on non-professionals' exploitation of databases:

- Due to their quick progress in query creation, they might become higher motivated in further improvement of their knowledge and, consequently, in their more effective and efficient exploitation of their databases.
- Design of some (very complex) queries via QBE is difficult, if not impossible. The non-professionals should be encouraged to recognize the limits of their expertise and ask ICT professional for their assistance.

E. Conclusions

Despite the fact that not all of our hypotheses have been confirmed, many of intuitively presumed advantages of QBE are correct. This should motivate educators to design and develop combined methodologies benefiting from positives of both: QBE and SQL.

Keywords: *introductory database courses; comparison of QBE and SQL; query formation; mental models of query processing*

State-of-the-art simulation systems for information security education, training and awareness

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Abstract—This paper describes state-of-the-art simulation systems designed for information security and information assurance education, training and awareness. Being people the weakest link in the implementation of any security policy, it is of paramount importance to strengthen that link before it gets broken. The best way of improving the reactions of any person when security is attempted to be compromised is by providing him/her with better education, attractive training and raising the general awareness on information assurance.

Keywords—information security; information assurance; network simulation; education; training; awareness.

SUMMARY

Information security has become one of the main priorities for governmental and private institutions. It has been shown in several occasions that a big amount of all security incidents is caused by human errors such as system misconfigurations, security policy breaches and careless systems administration. Since these actions were not done on purpose, most of them could have been avoided by improving the information security education of managers, the training of the system administrators and the general awareness of end users. Simulation systems are of great help for this task since they allow hands-on experience and user interaction.

This paper describes the results of a research on state-of-the-art simulation systems for information security and information assurance education, training and awareness. As first stage of the research, several of those systems have been identified and studied. The second stage makes an initial attempt to construct a taxonomy of the found simulators, following the one proposed by Saunders [1] in which five distinct categories of simulation for information security are defined and described: PacketWars, Sniffers + network design tools, Canned attack/defend scenarios, Management flight simulators, and Role-playing.

The found simulation tools have also been classified attending to their target audience, usability, learning curve required, level of detail, scalability, the possibility of being remotely used, etc.

Among all the simulation tools found during the research we are highlighting the following ones:

- **CyberProtect** is an interactive computer network defensive exercise developed by US DoD's Defense Information Systems Agency (DISA).
- The Military Academy Attack/Defense Network (**MAADNET**) simulation designed by United States Military Academy (USMA).
- **CyberOps: NetWarrior**, also from DISA.
- The cyber DEfense Technology Experimental Research laboratory (**DETERlab**) testbed.
- **CyberCIEGE** from the US Naval Postgraduate School.
- NIST IPsec and IKE Simulation Tool (**NIIST**).
- The Real-Time Immersive Network Simulation Environment (**RINSE**).
- The Reconfigurable Cyber-Exercise Laboratory (**RCEL**) for Information Assurance Education.
- **Tele-Lab "IT Security"** from the Hasso-Plattner-Institut für Softwaresystemtechnik GmbH.
- The Network Security Simulator (**NeSSI2**) developed at the Berlin Institute of Technology.
- **S-vLab**, an experimental environment for teaching Java security developed at the University of Bologna.
- A Windows Attack intRusion Emulator (**AWARE**) from Fairmont State University.
- **RADICL**: A Reconfigurable Attack-Defend Instructional Computing Laboratory from the University of Idaho.

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Session: 11E ANECA Special Session: New Directions in Engineering Accreditation, Quality and Course Design

New Directions in Engineering Accreditation

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Course design approaches for the EHEA. Scaling up from pilots.

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Directions in Quality

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New Directions in Engineering Accreditation

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Recent decades have seen internationalization of the engineering practices thus making engineering education an international enterprise. Graduates from a certain engineering program may have to work not only in a different state (in case of USA) or a different country. The graduate may also be working in a multinational company. This situation further increases the interest among the institutes to get their program accredited. An accredited degree program is the one that has gone through a rigorous quality control system and has been approved by a national or international accrediting agency or organization. The importance of graduating from such programs is growing with the increasing demand of global engineers.

Engineering educators need to focus on several key areas, among which are development of curricula, graduate studies, research, development and promoting university-industry ties, and accreditation. Accreditation provides an educational institution or a program with a credential. The credential is most often a public statement that the academic unit satisfies a set of quality criteria established by the accrediting body. Through the accreditation process, the faculty, the facilities, the student body, budgets, recruiting practices, admissions procedures, course content, and other pertinent issues come under thorough review. The accreditation process may operate at a broad or narrow scope. A panel discussion is organized to discuss new directions in engineering accreditation. EDUCON-2010 panel session will provide a unique opportunity to educators, researchers and technologists who are willing to discuss how they are integrating digital technologies, instruction, and

changes to university facilities in their programs seeking accreditation or how they think it should be done. It will also provide a forum for discussing and debating new directions and approaches relevant to accreditation with the engineering and academic audiences. Following are some of the relevant questions that we would like to address during this panel session;

- Does accreditation help to maintain quality of education?
- What is the impact of accreditation on traditional learning environment?
- Are traditional approaches to accreditation meeting today's need?
- What are some of the problems with accreditation?
- How can accreditation be reformed?
- What are the new trends in accreditation?
- What are the important issues specific to engineering accreditation?
- What incentives do faculty members need in order to commit to accreditation activities?
- What are the alternatives to accreditation, if any?

All these questions are the subject of ongoing attention and discussion by academicians, ABET and in various ways by other ABET member societies.

Course design approaches for the EHEA

Scaling up from pilots

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Abstract—After years of preparation and limited-scale pilot projects, full blown implementation of European Higher Education Area (EHEA) compliant degrees started in 2008 at the UC3M. This paper discusses the final stages of preparation, as well as the initial lessons from this go-live experience, focusing on a core (compulsory) second year subject of the computer engineering curriculum. Lessons drawn from the preparatory pilots are presented, implementation challenges are identified and analyzed, and both school-level and course-level required design approaches are discussed.

Keywords- *Bologna, EHEA, course design, curriculum development*

I. EHEA ADOPTION IN SPAIN

The 1999 Bologna Declaration, currently endorsed by 46 countries, aims at the creation of a European Higher Education Area (EHEA) based on international cooperation and academic exchange. It involves major reforms in the higher education systems, including: Common adoption of a three-cycle structure (e.g. bachelor-master-doctorate); Quality assurance in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG); Fair recognition of foreign degrees and other higher education qualifications in accordance with the Council of Europe/UNESCO Recognition Convention.

In Spain, the first EHEA-compliant bachelor degrees started in September 2008, among substantial controversy. 33 Spanish public and private universities, out of the 75 existing ones, offered 163 programs. By Sept 2010, all bachelor degrees must be EHEA-compliant.

II. PILOTS VS. GO-LIVE. COURSE DESIGN APPROACHES

The public university Universidad Carlos III de Madrid (UC3M) submitted a proposal for the replacement of all its existing engineering degrees by the new ones by Sept 2008. After completing the Quality Assurance review (ANECA), 8 out of its 10 undergraduate engineering degrees had new enrolments in the first year discontinued for September 2008, and were replaced by bachelor degrees (“Grado en

ingeniería”). The two remaining ones will be transformed in Sept 2010.

This paper discusses the pilots carried out, design process and actual implementation experience of a core (compulsory) first quarter / second year subject in one of the initial 8 degrees, computer engineering. It is being simultaneously taught in 2 UC3M campuses, both in English and in Spanish.

Given the resource limitations and institutional framework, the pilot projects showed that the participative, student-centric, outcomes oriented methodology could not be successfully scaled up unless design criteria were adopted that focused specifically on the viability of the implementation.

A number of implementation challenges were identified and analyzed, including: Resource constraints; Faculty motivation and incentive structure; Student motivation and cultural and institutional framework; Trade-off between homogenization and initiative promotion; grading accuracy and fairness.

Tackling these challenges required adopting various design approaches at various levels. At the university / Engineering School level, design decisions taken by UC3M’s engineering school include new, standardized rules for continuous evaluation and the across-the-board adoption of a common class schedule encompassing groups of different sizes.

Course level design approaches encompass coordination procedures for the small groups, grading processes, LMS support and Open Course Ware utilization.

III. CONCLUSIONS

The more tangible and formal EHEA elements, such as adoption of the three cycle structure, ECTS or Diploma supplements can be “imposed by decree” and will eventually be implemented. However, effective adoption of the supporting methodological and cultural elements, such as the shift towards an active learning, student centric, learning outcomes based approach is much less certain. The approaches and lessons discussed in this paper might be helpful in overcoming the stumbling blocks that hinder that implementation.

Session: 11F Area 2: Laboratory Experiences: on-site and remote environments - Didactics for experimentation

Dual Instructional Support Materials for introductory object-oriented programming: classes vs. objects

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Towards the loose coupling between LMS and Remote Laboratories in Online Engineering Education

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Three Online Neutron Beam Experiments Based on the iLab Shared Architecture

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Didactic videos about basic concepts on alternating current circuits

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Dual Instructional Support Materials for introductory object-oriented programming: classes vs. objects

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Abstract— Visualizations are widely used in programming courses but the integration of these software tools into classrooms is not straightforward since there is a lack of information about the real benefits for learning and how to combine them with traditional lectures. We describe in this paper an experiment of using dual instructional support materials (textual and visual programs) in the lab classes in a Java-based CS1 course. The approach consists of two phases: students work the class concept in a traditional programming environment and the object concept in a visual environment as Greenfoot. The experiment shows positive results in terms of concepts understanding in students with no prior programming experience. Therefore we also suggest this as a possible way for integrating visualizations to the course.

Keywords- Object-oriented programming, Visualization, Novice Programmers, Greenfoot

SUMMARY

Many studies have been carried out to know firsthand the main problems and difficulties in object-oriented introductory courses (CS1) both from the teaching and the learning point of view [1].

In a CS1 using an object-oriented language, it is crucial that students get a good understanding of key abstract concepts like object and class at an early stage. Since in our degree on Computer Science we follow an approach that combines a strong start in basic constructs with early object-orientation, we are concerned with this issue.

Novice programmers do not have a concrete model in their everyday life to handle with these abstract concepts. According to [2] between 75% and 83% of students are visual learners and, therefore, we could provide interactive visualizations for the students to concretize the abstract concept at the beginning of the course. Some of these visualization tools are devoted to help students “see” what an object actually is, as BlueJ, Greenfoot or Alice.

Encouraged by this trend, we decided to use one of these tools in a first semester course in object-oriented programming with Java in order to engage students and improve their

comprehension of the class and object concepts. However, the introduction of this software tools into the teaching practice is not straightforward since there is a lack of information about the real benefits for learning [3].

Consequently, using a visualization tool also implies to design a teaching strategy to make the use of such tools as efficient as possible from a pedagogical point of view. We have adopted an incremental approach separating and grouping concepts and stages. The class concept and the compilation stage are worked in a Java development environment. The object concept and its behavior are worked in a visualization tool for Java like Greenfoot [4], in which students’ programs can be run step-by-step or in continuous play mode without making changes in their source code. For that, we have developed several dual instructional support materials in order to work with the same examples in both environments.

We performed an evaluation study aimed at: (i) investigating the effect of using these dual instructional support materials in learning and (ii) examining whether these materials might contribute to better understand some basic object oriented concepts.

According to the results here shown, the use of the dual instructional material benefits learning: we found students using the visualization performed significantly better the questionnaires about object oriented concepts. Therefore, we recommend the use of this kind of materials for reinforcing.

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Towards the loose coupling between LMS and Remote Laboratories in Online Engineering Education

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Abstract— In this paper, we are providing a study on the issue of interoperating Learning Management Systems (LMS) and Remote Laboratories, in a seamless integration. This study emphasizes the need to make Remote Laboratories seen as a pedagogical material within the LMS. We are presenting a novel and original approach to make these two types of platforms communicate (LMS and Remote Laboratory) under a loose coupling relationship. The main purpose of this work is to bring a better follow-up of students to the tutor and the students themselves, and therefore to lead to an enhanced learning experience. (Abstract)

Keywords- Remote Laboratories, Distance Learning, Learning Management System, Interoperability, Learning experience, Hands-on Approaches, Personalized Learning, IMS-LD, SCORM.

SUMMARY

Remote training services exploded with the growth of the Internet. Information Technologies and Telecommunications appeared therefore as a keystone for the leverage of Remote Laboratories (RLabs) in Distance Learning curriculum. Before the last few years, ongoing research in Distance Learning primarily focused on conceptual teaching or case studies, in the form of remote courses, works directed remotely or remote projects, but without possibility of real practical activities.

Hands-on approaches however are mandatory in scientific and technical education, especially in engineering curriculum [1]. Mainly, this study emphasizes that hands-on approaches help the students in making the link between theory and real problems, in supporting motivation and curiosity, in

contributing to their personal development, in building social networks. Because heavy and expensive industrial et laboratories facilities can neither be moved nor easily duplicated, a lot of efforts were made for the development of platforms, which now allow remote interactions between geographically distributed users and a pedagogical materials hosted in the school [2,3,4,5], laboratory [6] or company walls [7]. In these publications, all researchers accord to observe that it is not enough to create an interactive Web Site: it is compulsory that the conditions of experiments are realistic, productive and protected. In Distance Learning, one could add that interoperability is another mandatory characteristic, as Learning Management Systems (LMS) are the containers of remote learning activities and student's follow-up, and they are not yet able to include remote hands-on activities, while they already host lectures, tests, etc. Remote practical works are therefore ignored, because excluded since of their low interoperability, from the LMS. This paper addresses the problem.

In this paper, we are primarily interested in the interoperability between any Learning Management System and any Remote Laboratory. We identify the LMS as the element in the Information System that endorses the role of exposing the teaching contents on line while ensuring the follow-up of the user learning throughout his course of study. The purpose of this article is therefore to propose new models of interactions between these two types of platforms (LMS and Remote Laboratory) for a better follow-up of students, and therefore an enhanced learning experience.

Three Online Neutron Beam Experiments Based on the iLab Shared Architecture

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Abstract - A joint team has developed three online experiments based on the iLab Shared Architecture that employ the neutron beam from the MIT nuclear reactor. The software architecture has made it possible to share this unique resource with other institutions. Initial assessment of the online experiments indicates that they achieve comparable educational outcomes to traditional versions of the lab executed in the reactor containment vessel.

Keywords - remote labs, iLab architecture, web services, engineering education, nuclear physics.

SUMMARY

Students at MIT have traditionally performed certain experiments in the containment vessel of the MIT nuclear reactor as part of courses in Nuclear Engineering and the third year laboratory course for Physics majors. A joint team of faculty and research staff from the reactor and MIT's Center for Educational Computing Initiatives has implemented online versions of three of these experiments:

1. Students measure the neutron absorption cross sections of several materials including polyethylene, cadmium, iron, lead and water.
2. The speed distribution of the thermal neutron beam from the reactor is determined using time of flight measurements generated using a beam chopper. This measured distribution is compared with the Maxwell Boltzmann distribution for the temperature of the reactor.
3. Students determine the DeBroglie relation between neutron momentum and wavelength by measuring the Bragg diffraction angle of thermal neutrons by a copper crystal as a function of their speed.

These online experiments were implemented using National Instrument's LabVIEW[®] virtual instrumentation package and the interactive version of the iLab Shared Architecture (ISA).

The ISA provides a standard set of web services in support of online experiments (iLabs) as well as open source code modules that speed up the development of such online experiments. Much of this common functionality is implemented in a domain independent server known as the Service Broker. The design of the *Service Broker* strictly separates the task of publishing an iLab from that of managing

the students using it. This separation encourages the sharing of such experiments between institutions. The Service Broker also serves as the gateway in such inter-institutional relationships. Once two institutions have mutually registered their Service Brokers with each other it becomes much easier to share iLabs.

The ISA also distinguishes the software program that controls the execution of the experiment (the *Lab Server*) from the application through which the student controls and views the experiment (the *Client*). The ISA supports many client technologies including Java applets, Java Server pages, Windows Forms clients, Adobe Flex clients and LabVIEW remote front panels. In the case of the neutron absorption experiment, the iLab team is currently developing a simpler version of the remote panel client for use in advanced secondary school courses in cooperation with the Queensland Academy for Science, Maths, and Technology (QUASMT). The ISA permits multiple clients targeted at different educational audiences to interoperate with a single backend Lab Server. This allows developers to leverage their initial investment in developing a fully featured Lab Server by adapting it to multiple audiences as well as encouraging refinement of the client's pedagogy in response to formative evaluation.

Initial evaluation of the neutron beam experiments has revealed a number of areas in which the experiment functionality and presentation can be improved. Even the initial version of the online lab, however, has achieved student educational outcomes comparable to the traditional version executed within the reactor containment vessel. The iLab version of the experiments possesses obvious advantages in terms of safety, security, and convenience for students.

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Didactic Videos About Basic Concepts On Alternating Current Circuits

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Abstract— This work emphasizes the importance of the formulation and application of didactic videos mainly in subjects where the classes are exclusively theoretical, as in the case of the subject ET016 – Electrotechnics, taught at the School of Electrical and Computer Engineering – UNICAMP. It is mandatory and it is offered to the students of the following Colleges: Food Engineering, Agricultural Engineering, Control and Automation Engineering, Mechanical Engineering and Chemical Engineering. In this subject, basic concepts of electricity are taught: single-phase and three-phase circuits; electrical energy production, transmission and application; physical principles and main application of transformers; electrical machinery of induction, asynchronous and direct current; and basic concepts of electric installations and protection devices. Upon elaborating and making these videos available, we aim at arousing a larger interest on the students, causing them to complement and reinforce the content taught at the attended theoretical classes.

Keywords- *Alternating Current Circuits, Electrotechnics, Engineering Education, Didactic Videos.*

SUMMARY

Historically, in the period from 1970 to 1980, there was a subject named ET515 - Electrotechnics at the School of Electrical and Computer Engineering (SECE) - UNICAMP - Brazil, lasting six hours weekly, with four hours in the classroom and two hours in the laboratory. From 1981 on, the subject ET616 – Electrotechnics started being taught using two hours in the classroom and two hours in the laboratory and from 2004 on, we also took the responsibility to teach the subject ET016 – Electrotechnics, with just two hours weekly in the classroom. Detail: all these subjects have the same summary imposed by the respective receiving courses.

Currently, ET616 and ET016 are offered to students from the following Colleges: Food Engineering, Agricultural Engineering, Control and Automation Engineering, Mechanical

Engineering and Chemical Engineering. In these subjects basic concepts of electricity are taught: single-phase and three-phase circuits; electrical energy production, transmission and application; physical principles and main application of transformers; electrical machinery of induction, asynchronous and direct current; and basic concepts of electric installations and protection devices. ET616 e ET016 do not have the same level of complexity as similar subjects offered to the students at the SECE.

Before the inescapable quality loss in transmission and the resulting assimilation of the content mentioned above, allied to our taking priority in the activities of the graduation teaching, and being aware about the students need in having a fundamental knowledge of good quality on alternating current circuits, the means we found to reduce such loss was the production and broadcasting of videos with exhibition of experiments, which are not accomplished by the students who currently attend ET016. Other important comments and analyses about the importance of the use of didactic videos, and how the recording must be done with details and precision in its captures, so that it becomes clear, having no illumination and image framing problems may be found at reference [1].

The knowledge disclosed this way is being useful to our students and to students from other teaching institutions, who may watch countless times, a specific concept on fundamental electricity. The videos and the way they are disclosed, bring up conditions so that the learning process happens in a more efficient and faster way, being available for a larger number of people, besides the students having the benefit of being able to watch the experiments when they have time, and be able to review the subject.

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Session: 99 Non traditional papers

Model of Virtual Laboratory

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**Higher Education Process Management Model, Educative Programs
Improvement in Software Quality**

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Model of Virtual Laboratory

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Abstract—This paper describes the importance of developing learning tools, such as virtual laboratories in different areas of science with emphasis in chemistry, through the development of a virtual laboratory that allows students to access to an environment of experiential learning. It has two main stages which are: a virtual world (software) where the student is guided by an integrated environment with the features necessary in order to perform the practices and at the same time, has a capture stage (hardware) that is responsible for making the process of experimentation as real as possible, offering the instrument's sensation or machine's sensation during the experiments. Throughout the document the steps for the completion of the virtual laboratory are seen with the results so far.

Keywords-chemistry, distillation; virtual laboratory; virtual reality.

VIRTUAL LABORATORY

Day after day the research designing and developing didactic tools that supported the teaching and learning process of students, it has been developing by economical and academics supported, principally for the impact that Technologies of the information and communication have been having in education. In this point, it is necessary that the educational material be at the same level with these technologies, offering interactive and innovators scenes that catch the student's attention and that it supports the contemporary teaching theories.

Being in this context, we can lay the virtual laboratories, as a new alternative simulators and educative games, which counts with a scenery in third dimension with some components that conform the laboratory, an interactive device (glove, helmet, dress), which allows students to get into a virtual world and a movement device that receives the students movement signs inside the virtual world and then give the sign to the computer to be process.

However, even there are some current development around this kind of tools, it is necessary to look for new alternatives that allow innovates and make easy the use of this sort of educational material, where the communication and information technologies play an important role.

Additionally, inside the chemistry teaching context, more specifically the laboratory process of simple distillation, chemistry students face a problematic that affects not only students of high school, but also those who are in the university; this problem comes with the uses process to resolve the different kind of problems (pencil and paper problems, practical problems, experimental problems), though teachers and student versions talking about the above mentioned failure are slightly counter-productive: lack of theoretical and procedural Knowledge of theory application, lack of strategies or ways of resolution, lack of understanding or overload of problems announcements (this are out of context, unreal, with deeper theoretical interest, indiscriminate data use), lack of students work, faults of mathematical calculation in students), scanty domain of the mathematical device (in students) and scanty domain of the hypothetical thought - deductive (in students).

It is possible to conclude that both teachers and pupils adduce the failures and their failures to external factors, without bearing in mind that the point of break maybe could be located in the educational perspective of the current pedagogic model.

If we approach an important part of the resolution of problems, we observe a phenomenon that happens often and not only in the sciences, and it is that the pupils limit themselves to looking for general formulae that solve always the above mentioned problems, or simply they limit themselves to hoping that the teacher solves the problem; this phenomenon creates an act that on having passed the time is complicated to suppress.

And to be the mechanical accomplishment of the problems, which carries to not understanding of the process that is what is looked; also guide the students on having approached new problems of a systematic and routine way, creating slightly desirable habits in the student in a world like the science. Some factors that still missed the current learning process on the part of the students are: identification and definition of the problem, to propose procedures, compilation and interpretation of results and capture of decisions. In the article there is a description of the context of virtual laboratories, a description of the solution proposed, the methodologies that we followed in order to develop it, and the results and conclusions obtained.

Higher Education Process Management Model

Educative Programs Improvement in Software Quality

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Abstract—: This paper presents a Processes Management Model for Higher Education (PMMHE) characterization. With the PMMHE is possible to produce a comparative measurement system (benchmarking) of organizational, tactical, logistical and operational processes for formation, training and coaching programs in higher education institutions. The current PMMHE's release has impact on engineering programs and emerges as a strategy of the Colombian Government in its effort to articulate the university and industry, particularly the software industry and education of software engineering and their related areas at technical, technological and professional levels. The model is defined as knowledge management tool, which provides a scenario of variables and requirements classified by process categories and areas, practices, resources and products of processes, in which the institutions can to develop assessment practices to exchange resources, knowledge assets and best practices. This scenario is seeking to promote the establishment of a process improvement environment in higher education programs of engineering. It is very important to emphasize that the model's strategy is the transition from the subjective to the objective, for obtaining impact and spread and internalization knowledge, beyond the mission statement of institutions. This derivation from hypotheses to the thesis supported in facts, leads the formal use of statistical process control for knowledge management which includes the measurement systems analysis and collect measures about teaching - learning collective and individual processes under constantly balancing between the theory and the practice about the scientific and professional aspect. Also, this paper presents the lessons learned and the assessment for applying the model to 58 companies and 5 institutions of higher education related with the software industry in Colombia.

Keywords- *Process Maturity Model in Higher Education; Measure Systems for Higher Education, Knowledge Management in Higher Education.*

SUMMARY

In the last 10 years, one of our lines of research work has been the development of quality management systems applied in higher education. The focus of our research is the several adaptations of software engineering's innovation frameworks.

Due that academic community at university-level in Colombia are using information and communications

technologies (ICT's) in their certification processes for their higher education programs, in great part achieved with our work, currently our actions are pursuing in way of get that the higher education institutions are developing strategies to formalize processes for management, authoring, instruction and assessment of the university programs offered in Colombia.

The document is divided into seven sections. In the first part, we establish introduction and organization of this paper.

In the second part, we provide an overview of the process and competences paradigms that allow defining the different kinds of educational processes. This way, the educative programs appears with organizational, primary, support and adaptive processes. Additionally, we present an overview of the three different studies that support the model proposed: Academic and Administrative Management of Educative Institutions, Quality Assurance System for Higher Education and Software Quality Colombian Network. Finally we establish the research problem we are trying to solve the model and the applications discussed in this paper.

In the third part, we propose that, if the educational programs are in crisis, a paradigmatic change as a discipline is required and we propose the management by processes support in competences for that change. In addition, based on maturity models arguments, we assume that all paradigmatic change can only be possible adopting a critical attitude and then promoting a new paradigm. This part ends with describing the specifications and architecture of the Academic Programs Framework: Knowledge assets management; Authoring, Development and Maintenance; and, Instruction, Certification and Professional practice.

In the fourth part, we exemplified by a studies case of on how it is adapting the PMMHE framework in training non-formal programs and undergraduate and graduate programs in various universities in Colombia.

In the fifth part, we explore the research future trends in the short term: Higher Education Accreditation and Assessment, Personal competences certification and Peers School.

Finally, in the sixth and seventh parts, we present the Conclusions, Acknowledgments and References of the paper.

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