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.; Engeenering Education.

I. INTRODUCTION

We present two Projects financed by Socrates Agency. The first in about the curriculum development of one ‘Information and Communication Systems’ Master; the second one is about its application and development in mobile leaning.

Internet-based Performance-centered Learning Environment for Curriculum Support (IPLECS) is a virtual campus platform for performance-centered reusable learning materials development, their composition and organization in performance-centered settings and their usage to support university curriculum in physics-engineering education. IPSS_EE is an integrated educational 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 sy stem has el ements of performance sy stem, el ements of traditional Web-based educational programs and automatic test sy stem. The sy stem uses a technology for improving students’ competency and performance by providing support for processing, analysis, and reflection on information and learning experience.

The idea of eeducational per formance sup port courseware is the existing courses in which the principles of performance support are implemented. In the second scenario, industry-used mobile performance support systems become part of higher education learning and instruction. Students learn how to use them when they perform particular work-related tasks. The social support scenario explores the opportunities created by Web 2.0 technologies (micro-blogging tools such as Twitter, social bookmarking and wikis) to connect people and facilitate their collaboration. In the fourth scenario, mobile performance support is part of a blended solution of knowledge distribution rather than a primary channel for content delivery. Mobile performance support is included in a broader constructivist instructional context and used only in particular times. Within the scenarios a set of pedagogical guidelines are formulated based on a number of theories: Four Components Instructional Design Model (4 C/ID) [2]; Cognitive Apprenticeship [3]; Cognitive Flexibility Theory [4]; Cognitive Load Theory [5]; Multimedia Learning [6]; Minimalism [7]; Design Theory of Problem Solving [8]; and Anchored Learning [9].

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 IE E LOM. Model and description of IPSS_EE LOs are useful for understanding their features, for enabling them in a virtual environment and for enabling their reuse across different learning sessions. A new curriculum in the field of science and technology - “Information physics and communications”, will be developed. Learning materials will be integrated into the complete program, developed and used in a virtual learning environment, with strong positive results in students’ learning.

The combination of performance support stems and mobile devices present both opportunities and challenges for work-based learning design. We describe four possible mobile performance support scenarios, namely: mobile perf ormance support courseware; industry-based mobile performance support systems; mobile social support systems; and context-based performance support.

The mobile performan ce support courseware repackage the existing courses in which the principles of performance support are implemented. In the second scenario, industry-used mobile performance support systems become part of higher education learning and instruction. Students learn how to use them when they perform particular work-related tasks. The social support scenario explores the opportunities created by Web 2.0 technologies (micro-blogging tools such as Twitter, social bookmarking and wikis) to connect people and facilitate their collaboration. In the fourth scenario, mobile performance support is part of a blended solution of knowledge distribution rather than a primary channel for content delivery. Mobile performance support is included in a broader constructivist instructional context and used only in particular times. Within the scenarios a set of pedagogical guidelines are formulated based on a number of theories: Four Components Instructional Design Model (4 C/ID) [2]; Cognitive Apprenticeship [3]; Cognitive Flexibility Theory [4]; Cognitive Load Theory [5]; Multimedia Learning [6]; Minimalism [7]; Design Theory of Problem Solving [8]; and Anchored Learning [9].

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The main reason for the application of Performance-centered Approach in mobile Learning 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 workers carries and uses constantly - except in education. The advanced ages for training are derived from providing learners with just-in-time and just-enough support. Given the trend to lifelong learning, many “students” are workers adults with full- or part-time jobs. Mobility offers them an opportunity to maximize their learning time.

Mobile devices are always available and can be used for a variety of learning functionalities - providing access to content (both informational and instructional) and for communication and collaboration purposes. They can be used with formal or informal learning purposes as well as performance support, i.e. for delivering information and support just-in-time and in informal learning purposes as well as performance support, i.e. for delivering information and support just-in-time and in informal learning purposes as well as performance purposes, and for communication purposes. The advantages for trainees are derived from providing learners with a job aid in their own work context. The trend to lifelong learning, many “students” are workers adults with full- or part-time jobs. Mobility offers them an opportunity to maximize their learning time.

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The main purposes of the mPSS project are 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 workers carries and uses constantly.

The projects objectives are linked directly to support the realization of an European Higher Education Area as much as the development of an innovative ICT-based content, an open educational resources online provision, testing innovative performance-based e-learning and contributing to mobile learning development in education.

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• Designing a sequence of easy-to-complex tasks;
• Creating opportunities for deliberate practicing these tasks: giving formative performance feedback;
• Gradually diminishing the amount of support (scaffolding);
• Adapting instructions to students’ knowledge level and learning style;
• Providing a variety of instructional stimuli (resources) and
• Allowing constant access to learning resources.

The system is characterized by using recent developments of information and communication technologies (ICT), presenting embedded performance support into the interface and functionality of the application. The system depends on how comprehensively performance and support are defined and how well they are operationalized in the architecture and in the interface of the system.

The Structure of the learning content, for all the courses in the ICS curriculum, lies in:

• Background information (facts, definitions, principles and theoretical frameworks)
• Examples (worked-out examples, modeling examples, demonstrations and simulations)
• Procedures, techniques and tools
• Presenting learning content
• Split-attention principle (People learn better when words, pictures and graphics are physically and temporarily integrated)
• Self-explanation principle (People learn better when encouraged to generate self-explanations during their learning)
• Guided discovery principle (People learn better when guidance is incorporated into a discovery-based multimedia environment)
• The main purposes of the IPLECS project are:

   The instructional design for Performance-centered E-learning of DIPSEIL, as a typical performance support system [11], [12], is an integrated electronic environment, which is available via Internet and it is structured to provide individualized online access to the full range of information, guidance, advice, data, images, tools and software to permit the user performing a task with a minimum of support and intervention by others.

IV. THE DESIGN OF THE IPLECS AND MPSS PROJECTS

In the IPLECS project, the ICS curriculum design has been developed having account of ‘The Principles of Performance Centred Curriculum’ and ‘The Instructional Design for Performance-centered E-learning’ of DIPSEIL, we have developed ‘The Workflow Model for an Information and Communication System curriculum’. With these elements teachers in charge from different courses have enough information for developing the ICS courses.

The Workflow Model also offers to the course developer complete guidelines, with explanations, and examples that give all the partners unified criteria for developing the courses and their activities supporting the ICT performance centered task design.

The IPLECS Workflow Model for curriculum development is based in:

1) State a reference situation in which the students will use what they are going to learn.
2) Formulate a few learning goals and clear and specific objectives oriented to competences.
3) Create learning tasks with performance support, to provide the students:
   • Background information,
   • Examples,
   • Procedures and
   • Feedback,
   in order to help the students to perform the task easier and also to facilitate their learning.
4) Summative evaluation.

The ‘Workflow Model’, at the same time that serves as a guideline to course developers, also works as a complete check-list for evaluation purposes of the ICS courses design, being used as a ‘PSS Validity Scale’.

The ICS Master Program and its Implementation Plan in DIPSEIL Platform

The ICS Master Program is integrated by 6 mandatory courses and 4 electives courses. The student should enroll 8 courses in total, divided into two semesters.

• Semester 1
  o Introduction to Information and Telecommunication systems (PU)
  o Realtime and Industrial Communications (UNED-DIEEC)
  o Internet Technology (DEIS)
  o Advanced Electronics for Information and Communication technologies (TUS)
• Semester 2
  o Satellite and Mobile Communications (PU)
Given the trend to lifelong learning, many “students” are working ad ults with fu ll- or part-time jobs. Mo bility offers them an opportunity to maximize learning time [13].

V. APPLICATION OF IPLECS TO MPSS PROJECT

Research by Stoyanov, Kommers, Bastaens and Martinez-Mediano (2008) [1], shows that the concept of performance support system (PSS) should be implemented adapted to the specific goals and characteristics of higher education. Thus, it is important to keep in mind the specific goals of education when developing the support to improve learning. This means that students should not only be supported to perform the task at hand well, but also to understand underlying processes and concepts. Therefore, we designed the performance support system (PSS). The solutions were based on existing learning theories and take into account different learning processes and educational goals. The following scenarios are distinguished:

- Mobile performance support courseware,
- Industry-based mobile performance support systems,
- Mobile social support systems, and
- Integrated mobile performance support learning.

Each scenario requires a different structure and presentation of the content and addresses different educational goals.

VI. THE EVALUATION STRATEGIES OF THE IPLECS AND THE MPSS PROJECTS

Our conception of evaluation is the following: ‘Evaluation is the systematic application of scientific methods to assess the design of one program or project, responding to some needs, having into account the specific goals and characteristics of higher education. Thus, it is important to keep in mind the specific goals of education when developing the support to improve learning. This means that students should not only be supported to perform the task at hand well, but also to understand underlying processes and concepts. Therefore, we designed the performance support system (PSS). The solutions were based on existing learning theories and take into account different learning processes and educational goals. The following scenarios are distinguished:

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The evaluation strategy of the IPLECS and the MPSS projects aims to study the total pur poses of the project. Our main objective is to validate the performance support system (PSS) in the perspective of the learning process and the learner and not from the perspective of mobile technology. [14].

Founding in results obtained in previous research in IPSS, we propose concrete instructional design steps for the implementation of PSS in mLearning. The scenarios are based on existing learning theories and take into account different learning processes and educational goals. The following scenarios are distinguished:

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user needs and requirements. This variable works as a strange variable that should be controlled, because in one online course the way that the platform or the ‘system’ works could affect the entire learning process and also the final results.

The instrument to evaluate platform is a ‘usability questionnaire’, which is shown in the Annex 1. Instruments. ‘Computer System Usability Questionnaire’ based on Lewis, (1995). Beside the questionnaire the platform is evaluated by the peer review technique before starting the courses. The projects partners and teachers, which will collaborate in the Implementation of the ICS curriculum, are the sample to evaluate the platform.

Attitude is a factor that could be an important influence in learning. Only when there is a favourable attitude towards the TICs an e-learner can effectively face web-based learning tasks. Learning requires a positive attitude from the users to show their full potential. [15].

In according with Anastasi [16], attitude is defined in terms of the tendency to react favourably or unfavourably towards a certain class of stimuli, was determined by visible, both verbal and non-verbal, behaviour.

We will use a questionnaire on ‘Attitude to learn by computer’, based in a Likert scale, valuing every item from 1 to 5, minimal to maximal agreement with the statement contended in every item.

To value the entire learning process we will use specific ‘reflective questionnaire’ a satisfaction indicators on the learning process. We will collect information by personal interviews to students and teachers, in order to check satisfaction indicators with the functioning of the program, the IPLEC and mPSS models and the dipseil-iplecs platform during the process, taking measurements from teachers and students.

We want to measure the satisfaction with the ICS curriculum, in relation with the ICS curriculum goals, and with the implementation process and their results. These are indicators of impact, in relation with the ICS Saster and IPLECS Model.

The research design is the proper of the evaluative research, focused on multiple sources and variables. The methodology is exploratory. We will use descriptive statistical analysis, and value analysis, using quantitative and qualitative data analysis as correspond to the evaluative studies.

The majority of curriculum evaluation models suggest evaluating the planned, enacted and experienced curriculum;

- The planned curriculum is the theoretical curriculum that one intends to implement, that is, the program
- The enacted curriculum is the curriculum that is actually implemented, the program in action
- The experienced curriculum represents the curriculum as it was experienced by its users, such as teachers and students.

Programs, processes and products should be evaluated. This means that we should evaluate not only the match between the objectives of the curriculum and performance outcomes, that means the effectiveness of the curriculum, but also how it is functioning during the execution of the curriculum and how is being used the resources, the IPLECS Model and the media through the dipseil-iplecs platform.

To summarize, we need to centre the curriculum evaluation in the following:

- Planned, enacted, experienced curriculum
- Process & product
- Objective & subjective variables
- Quantitative and qualitative data
- Teachers’ and students’ experiences

The data analysis that we will do are:

- Quantitative, descriptive analysis and correlation analysis, by means of the Statistical SPSS program.
- Qualitative, grounded theory, Content Analysis, with the ‘Quantified Content Analysis, Leximancer’ program.

The sample from which we are collecting information are the own course authors, teachers responsible of applying the ICS curriculum, their students, and the partners to validate the ICS curriculum.

VII. CONCLUSIONS

Our projects have time duration of two years and nowadays we are in the first years. The theoretical framework and the strategies and resources for its application and evaluation have already fulfilled. In the current year we are applying the course in both projects, and following the process to collect information to evaluate their application and results. The evaluation strategy, using quasi-experimental research methods besides qualitative one, gives a good expectative to be able to contribute to the scientific community about some advance in both projects, computer and mobile learning device.

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