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 3º course of the School of Computer Science of the University of La Laguna.**

Keywords: Design Thinking, UCD, HCI, elearning

I. INTRODUCTION

The Human Computer Interaction is a subject corresponding to the 3º 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.

Moreover, we have used several methods from the Design Thinking (DT) methodology into the phases of DCU methodology, in order to promote the creativity and empathy in the thinking of our further software developers. Then, 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 DT [3,4,5,6,7] 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 [8,9, 10, 11, 12]. This last learning activity was carried out in the design and development of the projects selected by students with the objective to increase the significant learning.

This paper is organized as follows: first of all we will present both methodological approaches, DT and DCU, then we will show how we have integrated the methodologies into an learning activity carried out with students of Human Computer Interaction subject of the Computer Science Engineering.

II. DESIGN THINKING (DT) METHODOLOGY

DT can be described as a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible. It is based on the idea of the designers has a singular way to confront the innovation: "a protocol to solve problems and to discover new opportunities". So, the principles and tools used to design objects could be applied to "design" services or new solutions to complex problems. However, DT is not related with how to "design" products, on the contrary, is about how to "apply a methodology" of design and about certain skills that designers has to solve complex problems that need a creative more than analytic thinking.

This human-centric methodology integrates expertise from design, social sciences, business and engineering. High performance project teams are capable of simultaneously applying these different points of view. It creates a vibrant interaction environment that promotes iterative learning cycles driven by rapid conceptual prototyping.

However, DT is supported on the following principles:

1.*Empathy*: a deep, empathic and multidisciplinary observation about the user's needs, including their emotions.

2.*Imagination*: the optimistic search of solutions, thinking more in "the desirable" than "the possible".

3.*Experimentation*: the visualization of the possible alternatives through the experimentation, the game and the construction of visual stories (storytelling) in cooperation with users.

4.*Collaborative prototyping*: the application of techniques of collaborative prototyping to create models that help to visualize alternatives and to validate in group.

5.*Integrative thinking*: the capability of integration and synthesis of factors that influences the user's experience.

6.*Iterative learning*: the iteration of observation-creation-prototyping-validation process the time what it would be necessary until to find the best solution.

This methodology is based not only in the "usability", but it is based in the "meaning" that people give to their context and the interaction with the product. In consequence, DT allows us to have a more complete vision of the user experience: emotional, cultural, cognitive, social, etc.

In addition, DT is a model of a creative thinking that could be applied in every area, following several stages:

1.To define the problem

2.To create and to take into account many options

3.To refine and to iterate with the selected options

4.To select the best option and to execute it.

We can summarized the DT in three large phases: 1) Understanding and observation, 2) Creation and prototyping, and 3) Testing and learning.

Tim Brown, the manager of innovation and design firm IDEO [13], defines the DT how a process centered in humans, and remarks the "human sight" of the designers. Moreover, he says that to know how the product is used is more important than the product does. It is applied a "activity-based approach" instead of based on the product. This way to see the context and the activity as a whole helps to discover new and innovative solutions beyond than the product.

On the other hand, the designers "learning by doing" into a laboratory where they can experiment in teams with several prototypes, putting in practice many creative techniques, such as: drawing, modeling, video recording, speed prototyping, storytelling (verbal and visual), photography and other techniques.

III. USER-CENTERED DESIGN (UCD) METHODOLOGY

User-centered design, is a comprehensive software development methodology driven by a clearly specified, task-oriented business objectives and a recognition of user needs, limitations, and preferences. Information collected using UCD analysis is scientifically applied in the design, testing, and implementation of products and services.

There are several standards that define how to design and evaluate software products with the human-centered process approach, such as: ISO 13407 (explains the activities required for user centered design), ISO 16982 (outlines the types of methods that can be used), ISO/IEC 14598 (gives a general framework for the evaluation of software products using the model in ISO/IEC 9126-1).

Based on the principles of ISO 13407, we cited ten methods that are recommended when developing software for interactive systems:

0. Assessment of needs

1. A stakeholder meeting

2. Context of use

3. Task scenarios

4. Evaluating an existing systems

5. Usability requirements

6. Paper prototyping

7. Style guide

8. Evaluation of prototypes

9 Usability testing

10.Collection feedback from users after release to inform any redesign.

Moreover, UCD is an iterative process where we have to develop several techniques in different phases:

a) User Analysis: A user analysis is generally conducted before project planning has begun, or during the early stages of a project. In cases where no formal project has been established, a user analysis may be conducted before project planning to provide business management with an understanding of the workplace that can help to determine if there is a need for systems development. For projects that are just beginning, the workplace evaluation may be used to help define the project scope and determine the project approach.

b) Task Analysis: Task analysis should be conducted during project planning to help define the project scope and determine the project approach. However, the task analysis cannot be conducted until after the business objectives have been defined. The task analysis may be continued through the early stages of requirements analysis.

c) Information Architecture and Initial User Interface Design: The information architecture and initial user interface design can be completed at a number of different points in the design process.

d) User Interface (UI) Prototype: The UI design is generally refined and the UI prototype completed as requirements definition is finished and system design begins.

e) Usability Testing: Usability testing can be conducted as soon as a working UI mockup or prototype is available. The earlier usability testing is done, the more effectively problems found in the testing can be addressed.

f) User Interface Specification: Generally, the UI specification is a living document that is begun as soon as the first UI concepts are created, and is completed once the final UI design is finished.

As we showed above, we can observe that both methodological approaches match not only in the conceptual part besides in the methods, techniques and phases. For this reason, we propose an integration of both, focused on which techniques from the creativity area of the DT could be useful in the UCD phases.

IV. INTEGRATION OF TECHNIQUES: CREATIVITY IN DESIGN

In order to start to work with the DCU methodology, students has to build a conceptual map of a project selected by themselves. The conceptual map given initially by the tutor, has the hole information about the methods, techniques of DCU and usability, organized in phases. This conceptual map

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will be building collaboratively in group under the supervision of the tutor. Each phase of the conceptual maps has one or more deliverables and the techniques applied must be selected adequately in each case, depending on the project of each group.

Regarding to the integration of the DT methods into the DCU methodology, specifically we have integrated the following in the phase of the design: 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 [Fig. 1].
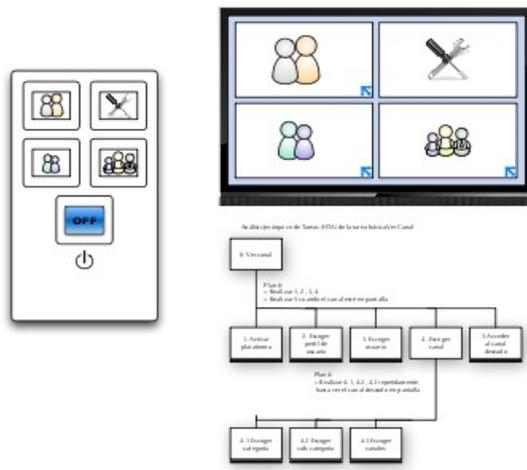

Figure 1. Example of a group proposal -DCU methodology.

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" [14,15]. 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 its 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" [Fig. 2].

Figure 2. Testing prototypes in the laboratory.

V. Conclusions

In this paper we have presented an learning activity to teaching DCU methodology using some techniques from the DT methodological approach. Through this kind of activities we also provided an overview of the main HCI techniques and methods illustrating that the user target and the methods used affect the end design. Our main objective with this kind of activities were to promote the creativity and empathy in the further designers of software, showing the key steps of a UCD process in an enjoyable and informal setting. We are absolutely convinced that we need to increase the creativity thinking of our students in order to improve their capabilities to produce innovative solutions and to create products and services adapted to real needs of users.

References

[1] L. Moreno, C.S. González, I. Castilla, E.J. González, J.F. Sigut. "Applying a Constructivism and Collaborative Methodological Approach in Engineering Education". Computers and Education Journal, Volume: 47 (3). 891-915, 2007.

[2] C. S. Gonzalez, F. Blanco, Integrating and educational 3D game in Moodle. Simulation and Gaming. Volume 39 , Issue 3, 2008. 399-413.

[3] Linden J. Ball Jonathan St.B.T. Evans Ian Dennis Thomas; C. Ormerod. Problem-solving Strategies and Expertise in Engineering Design. Thinking & Reasoning, Volume 3, Issue 4 November 1997 , pages 247 – 270.

[4] Diller, Steve, et. al. Making Meaning: How Successful Businesses Deliver Meaningful Customer Experiences. New Riders Press, 2008.

[5] Garrett, Jesse James. Customer Loyalty and the Elements of User Experience. Design Management Review, 2006.

[6] Dunne, David and Martin, Roger. Design thinking and how it will change management education. Academic of Management Learning and Education V.5 N.4 2006 p.512

[7] Bell, Steven J. and John Shank. Academic Librarian ship by Design: A Blended. Librarian's Guide to the Tools and Techniques. Chicago : ALA Editions, 2007.

[8] Snyder, C. Paper Prototyping: The Fast and Easy Way to Define and Refine User Interfaces. Morgan Kaufman: San Francisco, CA, 2003.

[9] Pruitt, J. and Adlin, T.. Person Lifecycle: Keeping People in Mind Throughout Product Design , Morgan Kaufman, 2006.

[10] User and Task Analysis for Interface Design Hackos, J.T., and Redish, J.C., Wiley: New York, NY, 1998.

[11] Klemmer, S. R., Hartmann, B. and Takayama, L. How Bodies Matter: Five Themes for Interaction Design. Proceedings on Designing Interactive Systems, ACM Press (2006), 140-149.

[12] Siegel, D. The Business Case for User-Centered Design: Increasing Your Power of Persuasion. interactions 10, 3 (2003) 30-36.

[13] Tim Brown. IDEO. http://designthinking.ideo.com/ convinced

[14] Svanaes, D. and Seland, G. Putting the Users Center Stage: Role Playing and Low-fi Prototyping Enable End Users to Design Mobile Systems. Proceedings of CHI 2004, ACM Press (2004), 479-486.

[15] Simsarian, K. T. Take it to the Next Stage: The Roles of Role Playing in the Design Process. Proceedings of CHI 2003, ACM Press (2003), 1012-1013.