A Systematic Approach to Usability Practices in Computer Science Curricula

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Abstract. The importance of Human-Computer Interaction (HCI) education for software professionals should be evident and well understood, when designing Computer Science (CS) programs, at all levels. Unfortunately there is a lack of HCI courses in Chilean CS programs. The first optional undergraduate HCI course was taught in Pontificia Universidad Católica de Valparaíso (Chile) back in 2003. Progressive steps were done, including the compulsory graduate HCI course (since 2006). A new project that allows the transition from isolated efforts to a systematic approach started in July 2007.

Keywords: Human-Computer Interaction, Computer Science Curricula, Usability Engineering Practices.

1 Introduction

The development of the HCI field, both as theory and practice, is poorly reflected in Chile. There is a lack of HCI courses in Chilean Computer Science (CS) programs and systematic research in HCI area. There are rather exceptions, due to enthusiasts. Research centers (as *Center for Web Research*, University of Chile) or companies that offer usability services are also exceptions [10]. The coordination of the isolated Chilean efforts in HCI is difficult to perceive (if there is one!), and the Chilean chapter of SIGCHI is still a "*Prospective Chapter*" [12]. There is a (quite general) governmental intent to offer guidelines for web-based systems development, including usability practices [11].

We are teaching HCI as optional subject in undergraduate CS curricula in *Pontificia Universidad Católica de Valparaíso* (PUCV), Chile, since 2003. A major step forward was the introduction of HCI as compulsory subject into the curriculum of *a Master Degree* (MD) program in CS (in PUCV), in 2006 [7], [8].

We are now trying to establish usability evaluations as standard practice over the whole CS curriculum. It is a new stage that allows the transition from isolated efforts to a systematic approach.

2 Previous Work: HCI Over the Computer Science Curricula

2.1 The HCI Optional Course in Computer Science Undergraduate Programs

We proposed an HCI course as optional subject in CS undergraduate programs of PUCV, back in 2003. The course mainly focuses on Usability and it is structured as follows:

- *The field of Human-Computer Interaction,*
- *The nature of Human-Computer Interaction,*
- *Computer system and interface architecture,*
- *Usability,*
- *Interaction design,*
- *Web design.*

We gradually increased the weight of practical activities, including as many practical exercises as possible, especially usability evaluations. Two *Usability Laboratories* were opened in PUCV in 2006, which are of great help in our teaching and research activity. These are the very first Software Usability Labs in the Central area of Chile, and some of the very few existing in Chile.

Students have to develop HCI projects: they have to apply the usability concepts, to cross-evaluate prototypes, and to improve them based on the evaluations they performed. They have to highlight the changes and the improvements they have made, in public presentations. As the undergraduate HCI course is open for two different programs, we strongly encourage the formation of mixed teams, including students that belong to different programs.

The HCI course is very appealing for the students. More than 60 students applied for the HCI course during the first semester of 2007, but (for logistic reasons) we were able to accept only 30 of them. We intend to offer a second optional course, *Usability Engineering*.

2.2 Software Engineering vs. HCI

There is a whole debate over the conflict between HCI specialists and software engineers [4], [5]. Fortunately it was easy for us to solve the "conflict", as we teach both *Software Engineering* and HCI. We are trying to take full advantage, always highlighting the strong relationship that should exist between the *Software Life Cycle* and the *Usability Engineering Lifecycle*.

2.3 Usability Topic Early in a Computer Science Undergraduate Program

Introductory CS courses usually focus on systems, ignoring users most of the time [3]. As we were teaching the very first introductory course in CS, it was up to us to stress from the very beginning the importance of the user over the system.

To only postulate the importance of the HCI and HCI practices is not enough, especially in the early stage of a CS undergraduate program. The approach has to be practical, always based on examples. We involve CS students in practical HCI activities from their very first semester. As HCI students always need test users, the freshman are (many times) good candidates for usability tests!

2.4 HCI Topics in Graduation Theses

The first undergraduate thesis in the usability field was developed in PUCV back in 2003. Since then, more and more students are choosing HCI or HCI-related subjects for their theses. We are currently supervising 8 undergraduate theses and 6 graduate theses.

Graduation theses on HCI or HCI-related topics had a tremendous impact over the diffusion of HCI, both among students and professors. They were important bricks in building the awareness of the importance of HCI when forming CS professionals.

2.5 HCI as Compulsory Subject in Computer Science Graduate Program

A major step forward was the introduction of HCI as compulsory course into the curriculum of the MD program in CS, a program that PUCV offers since 2006. We kept the main focus on usability, and usability evaluation, but we introduced new topics, as elements of semiotic engineering [1]. Besides usability evaluations, graduate students are performing communicability evaluations on a regular basis [2], [9].

As the compulsory HCI graduate course was very successful, we decided to introduce *Web Engineering* (usability and accessibility - oriented) as graduate optional subject. The interest was tremendous: 24 graduate students had to choose between two optional subjects that the MD program offered during the first semester of 2007, and 18 of them chosen *Web Engineering*!

2.6 Bureaucracy or Good Will: A Subjective Perspective

Table 1 resumes our experience in introducing HCI in PUCV, quantifying the efforts that we (subjectively) think are required in order to implement HCI practices ("*Bureaucracy*" or "*Good Will*"?) in CS curricula [6]. Most of the activities only require enthusiasts and "good will"! The only item that required "bureaucracy" was the compulsory HCI graduate courses. That is why we consider it a major battle won!

Table 1. HCI activities in CS programs in PUCV.

Activity	Activity Type	Level	Required effort
Usability and/or HCI topics early in the Undergraduate curricula	Compulsory	Undergraduate	"Good Will"
Usability and/or HCI topics in Software Engineering courses	Compulsory	Undergraduate	"Good Will"
HCI courses	Optional	Undergraduate	"Good Will"
Usability evaluations	Compulsory	Graduation thesis	"Good Will"
HCI or HCI-related theses	Optional	Graduation thesis	"Good Will"
HCI courses	Compulsory	Graduate	"Bureaucracy"!

3 New Challenges: A Systematic Approach to Usability Practices

Our 4 years experience in introducing HCI in CS curricula was officially acknowledged, and a new project was recently approved by the PUCV's authorities (*Integración de pruebas de usabilidad de software en las prácticas docentes de la Escuela de Ingeniería Informática*, June 2007). The project purpose is to systematically integrate usability evaluations (especially usability tests) into the formative process in *Informatics Engineering School* (*Escuela de Ingeniería Informática*) of PUCV, establishing usability evaluations as standard practice over the whole CS curriculum. It is a new stage that allows the transition from isolated efforts to a systematic approach, integrating the past experiences in a consistent frame, which will also include new proposals.

Three strategies were proposed:

- to develop a user centered vision early in the formative process of CS undergraduate programs,
- to establish software usability as main purpose of the software process, in curricula's subjects related to the software development process,
- to establish usability evaluations as current practice during the development of the graduation thesis (when the thesis involves software development).

The first strategy will be implemented by generalizing the introduction of HCI topics early in the CS curricula, in the very first course. As the practice is usually more appealing and persuasive than the theory, a good starting point is to include novice students in usability tests, first as test users, then explaining them the aim and the techniques of the performed tests.

The second strategy is meant to stress the importance of usability as basic attribute of the software quality, in all courses related to the software development process. A systematic approach should be used, both at theory and practice levels. Usability evaluation workshops will be organized for all CS undergraduate students. They will

offer a basic theoretical background and (mainly) the methodology of designing and performing usability tests, and interpreting the collected data, in order to identify usability problems and to propose appropriate solutions. Workshops will include, as voluntary supervisors, graduate students and students that develop their graduation thesis in HCI area.

The third strategy requires the agreement of the authorities and all the professors of the *Informatics Engineering School* of PUCV. The objective is to impose usability evaluations as compulsory practice during the software development process. Usability will have to be proved (not only stated) for all software products developed as part of the graduation thesis.

We hope that the project will complement the system-centered approach that the CS undergraduate students of PUCV presently have, with a user-centered approach. We will be able to enforce their theoretical HCI background with systematic usability evaluations, and eventually create the awareness of usability as a basic attribute of software quality.

The project will last the second semester of the academic year 2007. If the experience is successful, it will continue in 2008.

The short-term results will be evaluated by:

- questionnaires applied to workshops participants,
- a comparative study over the perception of usability and user-centered design in three groups of students: (1) those that studied HCI as optional course, (2) those that attended the workshops, and (3) those without any experience in usability (or HCI background),
- a comparative study over the perception of usability in two groups of first year's students: (1) those that participated in usability tests, and (2) those that did not.

The comparative studies will be based on questionnaires and interviews. The perception of the workshops participants over usability will be followed in a post-project study.

4 Conclusions

We consider HCI as a basic part of the formative process of the future software professionals. We focus on preparing HCI practitioners in undergraduate programs, and on preparing both HCI practitioners and researchers in graduate programs.

We were able to introduce HCI topics all over CS curricula, as we are teaching courses at all levels: *Computer Science Basics*, *Software Engineering*, *Human-Computer Interaction*. The practice is usually more persuasive than the theory. The experience showed us that an appealing way to introduce HCI at all computer science curricula levels is by systematically including usability practices.

New projects are undergoing or will start soon. Some of them require only "good will", as the new optional subjects *Web Engineering* and *Usability Engineering*. Some others involve "bureaucracy", as the systematic approach to usability practices, over the whole CS curricula, a project that requires the support and/or participation of our colleagues, professors of *Informatics Engineering School*. The fact that the project was approved by the PUCV's authorities is not (only) an acknowledgment of our

efforts, but a rewarding prove that the awareness of the importance of HCI practices is now a reality in PUCV.

Acknowledgments.
Our thanks to *Pontificia Universidad Católica de Valparaíso* (Chile), which made possible the experience described here. We also thank to SERG (*Semiotic Engineering Research Group*), of *Computer Science Department* of *Pontificia Universidad Católica de Rio de Janeiro* (Brazil), especially to Prof. Dr. Clarisse de Souza, for all the support and continuous encourages.

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