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Investigating the effect of realistic projects on students' motivation, the case of Human-Computer interaction course

Jaime Urquiza-Fuentes, Maximiliano Paredes-Velasco*

LITE — Laboratory of Information Technologies in Education, Universidad Rey Juan Carlos, C/ Tulipán, S/N, Móstoles, 28933, Madrid, Spain

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ABSTRACT

The aim of this study is to test the effect of a concrete way to use practical exercises in a human-computer interaction course. Our approach is focused on lab sessions, replacing typical concrete exercises with realistic projects based on collaborative work, long term duration (the whole course instead of concrete labs) and multidisciplinary design interacting with real end-users. The realistic projects approach supports the practice of theoretical concepts together with professional skills development, e.g. social skills needed to interact with end-user without technical background. In order to assess this approach we have conducted a comparative study with three different groups involving 133 students. Two groups followed the realistic projects approach, the difference between them was end-users recruitment. End-users were recruited by teachers in one group and by the students in the other. The third group followed the typical approach. Our comparative study is based on students' motivation. We have chosen the Situational Motivation Scale as the measurement instrument. Results show that, independently from the end-user recruitment, students involved in realistic projects are significantly more motivated than students involved in the general approach. Thus, students involved in realistic projects perceive that these activities are useful or important for them.

1. Introduction

The educational context of this work is a Human-Computer Interaction course taught at the Computer Science Engineering degrees of the Universidad Rey Juan Carlos. This subject is focused on software user interfaces. Two different approaches can be used to teach this subject: implementation and design. The former deals with software development libraries from different languages used to produce graphical user interfaces. The later deals with the user centered design (UCD) process. This work is framed in the later approach. Thus, UCD assigns end-user the main role throughout the user interface design process: from the requirement phase, through design and implementation, to the evaluation phase.

Most of the subjects within the computer science scope can be taught using methodologies that mix theoretical sessions and simple practical exercises. Thus, these exercises exemplify the concepts explained during theoretical sessions. Instead of following this classical methodology we use a more active approach based on realistic experiences related to the subject. Instead of simple exercises, these experiences are based on real problems where students have to face the whole development process of a user interface, from requirements to evaluation.

As we have said, UCD assigns a main role to end-users throughout the development process of user interfaces. In order to make these experiences more realistic, our approach also includes the participation of end-users. Usually, the end-user role has been played by other Computer Science (CS) students, even belonging to the same course. This approach is easy to use because teachers do not need to recruit non-CS students. On the other hand it hides an important problem that an interface designer will face in real life, i.e. communication and cooperation with end-users without technical background. Consequently, our approach integrates non-CS students as end-users. These students are enrolled in Infant and Primary Education Degrees. In terms of the UCD, this mixture of participants with different technical background is called a multidisciplinary approach.

Finally, following the realistic approach, these experiences will be faced by CS students as a group work task using a collaborative methodology. Thus, each member of the group will be on charge of different parts of the development process, but sharing the main

* Corresponding author.
E-mail addresses: jaime.urquiza@urjc.es (J. Urquiza-Fuentes), maximiliano.paredes@urjc.es (M. Paredes-Velasco).

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objective with the rest of the members of the group.

In our opinion, integrating non-CS students as end-users increases the realism of these experiences. Thus, this realistic approach could improve students' motivation towards these experiences and the subject where they are integrated. Both, student's engagement and motivation significantly impact on the learning process. Therefore, the more engaged the student, the more effective the learning. In order to measure the effect of this approach on the students' motivation, we have used a Situational Motivation Scale (EMSI) (Martín-Albo, Núñez, & Navarro, 2009). Finally, in terms of students' motivation, we will compare our approach against two other groups where different approaches have been used.

The rest of the work is structured as follows. Section two reviews related works regarding HCI teaching and the role of motivation in education. The third section describes the educational context together with the design of our realistic approach. Section four details how motivation has been measured and section five explains the experiment that we have conducted to assess our approach. The results of this experiment are detailed in section six and discussed in section seven. Finally, section eight draws the conclusions of this work.

2. Related works

2.1. Human-computer interaction curricula

Human Computer Interaction (HCI) is part of CS degrees programs. HCI is defined as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett et al., 1992). HCI has a multidisciplinary character and involves technical methods from CS together with social methods.

HCI curricula have diverse contents due to its multidisciplinary character. Churchill, Bowser, and Preece (2013) surveyed and interviewed more than 300 researchers, practitioners and educators of different continents regarding the core issues of HCI. This survey concludes that core issues of HCI are varied, e.g. social media, natural language processing, social network analysis, robotics, etc. ACM SIGHCI provides an HCI Curricula based on three main aspects: Human-computer Interaction and Human Characteristic, Computer System and Interface Architecture and, Development Process (Hewett et al., 1992). However, educators focus on different aspects; for example, Cockburn and Bell (1998) focuses on human disciplines like elemental psychology, ergonomics, UCD and task models (e.g. GOMS). Feng and Luo (2012) and Moroz-Lapin (2008) focus on requirement analysis and usability evaluation. Other HCI courses deal with requirement specification, design and evaluation with low and high fidelity prototypes (Koppelman & Dijk, 2006; Culén, Mainsah, & Finken, 2014; Lorés, Granollers & Aguiló, 2006). Our HCI course also deals with these contents using two main textbooks (Dix, Finlay, Abowd, & Beale, 2004; Shneiderman & Plaisant, 2010).

2.2. Teaching methodologies in the human-computer interaction course

Usually, the duration of the HCI course ranges from ten to twelve weeks. The instruction methodology includes theoretical lectures, practical lectures and laboratory sessions distributed in two sessions per week one or 2 h long (Koppelman & Dijk, 2006; Moroz-Lapin, 2009). Both, theory and practice are considered essential in HCI teaching (Churchill et al., 2013). Some educators incorporate seminars involving participants from the industry (Culén et al., 2014; Hartfield, Winograd, & Bennett, 1992). Many HCI pedagogical approaches include requirements analysis, design, development and evaluation (Greenberg, 2009) so the practical assignments consist of practical projects where students have to work on these contents. These practical projects are faced by students as teamwork (3–6 students per group) (Chambel, Antunes, Duarte, Carrico, & Guimaraes, 2009; Cockburn & Bell, 1998; Culén et al., 2014; Feng & Luo, 2012; Hartfield et al., 1992) and it is usually based on case study methodology. Several case study techniques can be used in this approach: history review, problem-based learning or decision-making cases (McCrickard, Chewar, & Somervell, 2004). Furthermore, case study methodology provides an opportunity to design real-word artifacts, which is an important aspect in HCI learning (Culén et al., 2014).

Students play several roles in practical projects methodology: designers, developers, users, clients, etc. (Chambel et al., 2009; Cockburn & Bell, 1998; McCrickard et al., 2004), but this approach limits the development of social skills in HCI. Students think social tasks are more difficult that technical tasks (Moroz-Lapin, 2009), so they should be used in HCI teaching (Hewett et al., 1992; Moroz-Lapin, 2008) like debate or discussion. Moroz-Lapin (2008) points out that students should work with real end-users, thus they could have a sound experience of collecting clients' needs and perceptions. Koppelman and Dijk (2006) sign out "student need to understand how a client feels and acts during the development of a system".

Realistic projects provide a context where students have to carry out social and technical assignments. Rosson, Carroll, and Rodi (2004) point out that projects should be realistic but manageable in an educational context. Hartfield et al. (1992) provide a pseudo realistic project approach based on mentors. These are participants with a solid industrial background regarding software development and consulting, their main responsibility is to lead and suggest students, but sometimes they play the end-user role as well. Koppelman and Dijk (2006) and Moroz-Lapin (2008) provide realistic projects inviting people from industry, they play two roles clients and end-users. Realistic projects support students in getting deeper understanding about realistic settings and the industry domain (Moroz-Lapin, 2008). In addition, Hartfield et al. (1992) point out those realistic contexts provide an environment where students can improve their workgroup skills. Given that user interface development is part of interactive software development projects, from a software engineering point of view, realistic approaches provide students with knowledge and skills needed to design and create software products that satisfy clients and users (Koppelman & Dijk, 2006).

However, the realistic projects approach in HCI teaching presents some problems (Koppelman & Dijk, 2006). Student-user communication is difficult because the user is kept at a distance and students feel little need to involve the user in the design process. Students sometimes interact clumsily with the user: when they show work carried out to user they present reports focused on technical details, while the user is interested in the look and feel of the interfaces at that moment (Koppelman & Dijk, 2006); or they present an extensive detailed reports while the user is only interested in a summary. Students usually think that the user is easy to please, so they do not take into account users' needs or expectations (Polack-Wahl, 1999).

2.3. Motivation in education

Literature about the role of motivation in education is wide. Thus, here we only mention those works that are closer to our domain. Motivation is a core aspect in active learning processes (Pintrich, 2003; Rienties, Tempelaar, Van den Bossche, Gijselaers, &