

USING TABLET PCS IN CLASSROOM FOR TEACHING HUMAN-COMPUTER INTERACTION: AN EXPERIENCE IN HIGH EDUCATION

André Constantino da Silva, Daniela Marques, Rodolfo Francisco de Oliveira and Edgar Noda
Instituto Federal de São Paulo – Campus Hortolândia – Hortolândia – SP – Brazil

ABSTRACT

The use of computers in the teaching and learning process is investigated by many researches and, nowadays, due the available diversity of computing devices, tablets are become popular in classroom too. So what are the advantages and disadvantages to use tablets in classroom? How can we shape the teaching and learning activities to get the best of this technology? To try to answers these questions we offered a course in a classroom equipped with tablets and made some observations that are relevant in this context. We offered one pilot course about Human-Computer Interaction employing the Tablet PCs in classroom. This article presents this experience and some insights perceived after reflection on the action. We conclude the needs to change the teaching and learning activities when adopt tablets in classroom to get the advantages of this device and minimize the disadvantages: tablets can motivate students but can be a distract tool too.

KEYWORDS

Human-Computer Interaction, Informatics applied on Education, Teaching and learning activities, touch and pen device.

1. INTRODUCTION

Devices, such as smartphones and tablets, are becoming increasingly popular; most of them have touch screen displays, access to the Internet and enough computing power to process Web pages. The Tablet PC is a computing device designed to “imitate” a notebook, allowing the user interact with a pen. Due the increasing of tablet usage, it is important to study how to use this computing device in the teaching/learning process. In this work, we based on the Valente’s definition for Informatics applied on Education “refers to the integration of the computer into the process of teaching/learning of curriculum areas at all levels and education modalities.” (Valente, 1999). Valente discuss about the ways to use the computer in class: “computer based activities can be designed to continue transmitting information to the student and, therefore, reinforcing the instructionist process, as much as they can be designed to create conditions for the student to build his own knowledge.”

About the computer’s use for knowledge construction, Valente says, “In this case, open ended general-purpose software such programming languages and multimedia authoring systems can be used, as well as applications software such as word processors and software for the creation and maintenance of database. In each of these situations, the student uses the computer to solve problems or to accomplish tasks such as drawing, writing, calculating, etc. The construction of knowledge arises through the student’s search for new information within the subject matter, and for new strategies, in order to increase his already existing level of knowledge about the topic that is being treated using the computer.”

Based on the usage of the technology to create conditions for the student to build his own knowledge, in this work we present a study to explore the use of tablet equipped with touch and pen sensitive screen in a course. We chose the Design of Human-Computer Interface (HCI) course because we want to prepare professionals with sufficient knowledge to build interfaces not only for desktop computers, but also for emerging technologies such as touchscreen devices. Section 2 describes the HCI course’s structure, the used tools (general-purpose software as handwrite text editors for tablet) and the methods. In Section 3, we present some using examples of the tablet in classroom. In Section 4, we describe some perceptions and some considerations based on this experience.

2. STRUCTURE OF THE COURSE, MATERIALS AND METHODS

The Design of Human-Computer Interface course - MC750 (Institute of Computing, 2014) covers the main topics of the Human-Computer Interaction (HCI) field in a total workload of 120 hours, distributed in four classes per week. ACM SIGCHI (1992) describes, “HCI is 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”. Barbosa and da Silva (2010) describe, “The HCI field is interested in the quality of use of these ‘interactive’ systems and their impact on the lives of their users”. They complement “according to Hewett and his colleagues (1992), the HCI’s objects of study can be grouped into five interrelated topics: the nature of human-computer interaction; the use and context of computers; human characteristics; computer system and interface architecture; and development process”. According to Barbosa and Silva (2010) claim, “knowing these technologies and devices is critical to be able to propose, compare, evaluate and make decisions about alternative ways of interaction with computer systems”.

Emphasize the rapid technological developments related to the peripheral interaction of computing devices. Preece et al. (1994) have pointed these problems: “how to deal with rapid technological change? How to ensure that the design provide good HCI while functionality and exploring potential new technology?”. However, what was 'new technology' in current times? Hayes (2008), supported by reports from the Gartner group, which describes one of the major challenges for the field of Information Technology and Communication (ICT) over the next 25 years are natural and non-tactile interfaces and automatic speech translation. Kugler (2008) points out for the tendency to replace gradually the mouse by emerging alternative interfaces that work with facial recognition, motion and gestures, and Shneiderman (2006, p. 10) points out for “the new computing technologies would include wall-sized displays, palmtop appliances, and tiny jewel-like medical sensors and fingertips computers that change your sensory experiences and ways of thinking”.

In 2006 and 2007, we given special attention to unconventional devices such as Tablet PCs, PDAs and mobile phones in our courses, using examples and including expository lectures interspersed with the achievement of individual and group activities about them. Analyzing the market at that time, we realized the need to prepare professionals with sufficient knowledge to build interfaces for these devices, which materialized if we analyze the high number of mobile devices manufactured and sold today. Aiming to introduce HCI concepts that would allow undergraduate students to know and explore new interaction technologies and IT infrastructure advantage acquired by a HP awarded project, we offered the MC750 – Design of Human-Computer Interfaces course in the second half of 2007 for students of Computer Science and Computer Engineering, UNICAMP, using Tablet PCs in the classroom. This experience was not shared in the scientific or educational HCI, and considering the current employment landscape of tablets and other computing devices interact with the pen, some insights and learnings, reported in this article, become even interesting to share.

The Tablet PC is a computing device designed to “imitate” a notebook, allowing the user interact with a pen. Resuming, the Tablet PC has the following hardware characteristics: (i) pen sensitive screen; (ii) screen that allows different positions; (iii) wireless network access by WLAN and bluetooth technology; (iv) microphones and embedded loudspeakers; (v) keyboard (some models the keyboard are detachable); (vi) batteries. In this work, we used tablet of the HP TouchSmart TX2-1040br model, a 2.2 GHz dual-core processor computer with 3 GB RAM and a 12” touchscreen. The installed operation system was Windows Vista with Portuguese manuscript recognizer. This model has the design similar to HP laptops but it is equipped with the described hardware for Tablet PC.

One tool used in classroom was the Classroom Presenter, a “Tablet PC-based interaction system that supports the sharing of digital ink on slides between instructors and students” (Anderson et al., 2006) and “making it possible to combine the advantages of whiteboard style and slide based presentation. The ability to link the instructor and student devices, and to send information back and forth provides a mechanism for introducing active learning into the classroom and creates additional feedback channels” (UW Classroom Presenter, 2014). The version adopted, developed by Caceffo et al. (2009), had modifications to compare students’ answers and dispose them in spiral form, turning easily to compare the answers and choose which one to discuss.

Another tool used was the Windows Journal, a software that allow users to do manuscript annotations and some functions to change the width and color of the ink, highlight, select and erase annotations, and insert figures. The Windows Journal Viewer software is necessary to view the file in a desktop computer.

3. USING THE TABLET ON TEACHING AND LEARNING ACTIVITIES

The first use we want to highlight is the use of the Tablet PC with Classroom Presenter to collect and build a common understanding of concepts before formal definitions of exposure. In this use case, we put a question on top of the slide asking the student to define the concept that were being worked on, which should be handwrite by the student in the appropriate space and sent to the teacher after do it. The teacher can analyze the responses as she receives, separating the answers she want to discuss with the students. For example, this technique was used to know what students understand about the term usability.

The second use we want to highlight is related to the features in the Caceffo et al. (2009) version of Classroom Presenter. During the classes about the Nielsen’s heuristics, the material was divided into two parts: the first part shows each one of the ten heuristics, explaining them and give one or two examples of violations. The second part consisted of an activity where students need to look for violations of the heuristics. In previous semesters, we applied the same exercise but, since the teacher does not use the Tablet PC, the teacher projected the user interface to be analyzed using a projector. After a time for the students do the identification of the violations, the teacher asks for the students pointing out the found violations for each heuristic, discuss them and do a mark in the user interface. This activity was adapted for the Tablet PC with Classroom Presenter, repeating the user interface to be evaluated in 10 slides; each slide would be for the student mark the violations of the heuristic described on the top. After a time to do the evaluation for the heuristic, students sent their marks to the teacher's tablet, so the Classroom Presenter compares the marks made by a student with the teacher answer, previously registered. Considering the feedback of the teacher as the correct answer, students' answers were distributed in a spiral form; the teacher’s answer is in the center and the students answer as disposed in the spiral placed: as more similarity the student’s answer is for the teacher’s answer, closer the student’s answer will be of the center. This enables the teacher to have an overview of the answers (how many are far from her answer) and analyze the answers that are from the center, discussing them.

The third use we want to highlight is the use of the Tablet PC with Windows Journal to produce a report using the heuristic evaluation method. In a second class about Nielsen’s heuristics, students were grouped up to five students, each group would have only a Tablet PC to identify violations of the heuristics in a user interface. In this activity, students inserted images from the user interface and marking the violations (and justifications) using the Windows Journal. Figure 1 shows, in a partial way, the report done by a group where it is possible to see how the students organized their response: in the left, they put some rationale about violation, and, in the right, the user interface with the marks. In red are the considerations done by the teacher after analyze the activity. It is important to highlight that one of the groups chose to enter the answer instead of handwrite it, delivering a text file without images and only textually describing the violated points.

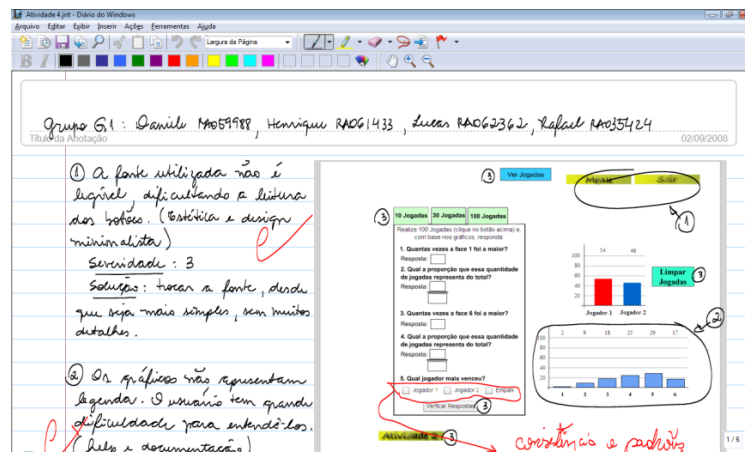


Figure 1. Answers of a student group for an exercise to find violations of usability heuristics and corrected by the teacher. In the left there is the evaluated user interface, and in the right the students reasoning. In red, the teacher annotations.

The fourth point we want to highlight is a homework where the students had to develop a user interface for a mobile phone or tablet application; each group could define the scope to work. It was suggested to the students to do artifacts such as personas and scenarios and to do an initial design, evaluated using the heuristic evaluation method, before presenting and discuss with the teachers and other students about the designed interfaces. This activity was important to understand the relationship between the two key stages to develop the interface of an interactive system: the design and evaluation; and consider their impressions about tablet and mobile devices in the design of a user interface for these devices.

During the course, a discussion forum was used for the students to put their impressions. In the middle of the course, some students posted their impressions that disagree with their first impressions and expectations. One negative point described by the students was the distraction of using the Tablet PC in the classroom; the teachers observed it and pointing out in their reports. This feedback was important to motivate teachers to change the teaching methodology trying to get a greater student's participation, e.g., collect examples or definitions on the internet related with the subject.

At the end of the course, the students and teachers answered a questionnaire to understand the impact of using the Tablet PC in the classroom (da Rocha et al., 2008). The students were questioned about the habit of taking notes about the content of the subjects during class, 66% of respondents said they rarely take notes in class, 11% response that take notes, and 23% say that did not take notes. May be this is related to the profile of the students, but the equipment will probably not change the students' habit, as perceived by the teachers. Teachers and students were questioned about the importance of students to have contact with Tablet PC technology in the course. About it, 100% of teachers and 58% of students believed that this contact was important.

Teachers also asked about the main differences observed by them in a class with the Tablet PC and a class without using the Tablet PC. One of the teachers argued, "the main difference is the interactive participation of students through the tablet. Not that the traditional classroom does not allow student participation; however, the tablet facilitates the teacher to show everyone what the students produced. However, the teacher needs to plan and prepare the students' participation and what will be done with the participation. This planning is not easy at first, because it requires a change in how the professor prepares its class". Another teacher commented about the impact of using the tablet to solve exercises in the classroom "it is possible to allow students participated in different way when do exercises ... the teacher can choose some resolutions to comment ... or discuss in a more general way. Without the support of Tablet PC, there is need volunteers to write their resolutions on the board; when I use the Tablet the resolutions do not need to be rewritten, which reduces the time spent in an exercise. For now, I observed that the students performed few annotations. The better advantage was the possibility previously said". A third teacher pointing a negative impact "...a class with Tablet (and Classroom Presenter) generally takes longer to start because everyone needs to pick up the Tablets, plug them in, log in, connect to the Presenter and wait for the slides transfer". This teacher points out the importance of planning different classes "there are also a need to change the preparation and conduction of the lesson to encompass equity/student interactions via Tablet".

In this exploratory study, a learning environment (TelEduc) was used to support the course; so participants used multiple devices to access it (tablet, desktop computers and mobile devices). In some classes, students accessed the environment using Tablet PCs; this allowed students perceive the nuances of software designed for mouse and keyboard, and the impact of trying to use another interaction style, in this case, the pen. Therefore, the environment itself is also an object of study and discussion in the discipline.

4. PERCEPTIONS AND FINAL CONSIDERATIONS

In this paper, we described an exploratory use of Tablet PC in a Human-Computer Interaction course based on the usage of the technology to create conditions for the student to build his own knowledge. Despite the attractive role of technology, especially in students of computing courses, which makes the students go to the classroom to know and use the Tablet PC, we emphasize the importance of developing support materials considering the usage of this technology in classroom. In the described experience, students made few annotations in theoretical slide-based lectures (as expected by the researchers), then the device turn into a distraction tool in these lectures, corroborated by the testimonies collected by the students.

In this study, the technology could not change the habit of the students, as they answered that do not usually take annotations in classes.

It is noteworthy that, despite the existence of applications for classroom to explore the potential of pen, as mentioned in the previous section, we realized the lack of tools that enable other dynamics in classroom, such as conducting activities in peer-review style, in which one a student examines the work of another student. In the case of the Classroom Presenter application, only the teacher received the students' responses, making it impossible for students to evaluate the work of another student without the mediation of the teacher's device.

About the importance of the contact of new technology, just 58% of the students believed that is important. Maybe some of them found the Tablet PC a distract tool or the content explaining this device plus the content for how to design for this device maybe enough for their purposes. Further investigation must be done to answer it.

In this study, the students could not take the Tablet PC for your home or another location outside of the classroom. Therefore, it was necessary that the contents built by students and the teacher in classroom be accessible on devices that students have, such desktop computers, enabling them to review and study the content taught outside the classroom. Reflecting about the current state of technology, where tablets, smartphones, digital whiteboards, and other conventional devices are found in the market, we believe that it is necessary to go beyond than provide the access to ICT tools using any device or any means. It is necessary to consider that the number of peripherals is increasing over the years and these peripherals allow users to interact with applications differently than usual.

As future work, we plan further to explore the use of different devices in the Human-Computer Interaction course in the first half of 2015 on the Federal Institute of São Paulo Campus Hortolândia using a variety of equipment based on pen interaction, such as smartphones and tablets.

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