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Technology-enhanced learning scenarios based on digital ink & tablet PCs

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Abstract

Numerous studies show that ICTs can bring about major changes in the classroom, thereby easing some of the problems associated with the traditional model of instruction. There is widespread consensus that digital-ink technologies (Tablet PCs) have great potential for encouraging interaction in the classroom and promoting a more dynamic learning environment. However, it seems convenient to support instructors who plan to incorporate these technologies, by conceptualizing their educational capabilities. To this end, this work addresses an approach based on the use of concept maps. During the three last years, several experiences were successfully implemented and tested in different Computing disciplines.

1. INTRODUCTION

In relation to the teaching and learning models, a recently published report (Fundación Telefónica, 2011: pp. 47) states, "A trend toward a participatory and collaborative model has been noted, in which learning takes place as the student performs activities and acquires knowledge through interaction with the environment." The report goes so far as to state, "It is anticipated, for example, that in the year 2015, 80% of university professors will be using new, ICT-supported didactic models in their classes.

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In general, we could say that teaching strategies must move from the still widespread traditional lectures and concept-based teaching to student-centred and competency-based instruction. However, these changes may sometimes produce some issues related with students' attitudes and motivation, instructor workload, logistic issues, or even reluctance to the changes. In this context, there are evidences that technology can drive major positive changes in the classroom, helping to face these problems. In particular, the flexibility of Tablet PCs and other digital-ink enabled devices have demonstrated their potential, at the college level, to achieve a wide range of educational goals as well as promoting a more participatory classroom environment (Sneller, 2007; Tront, 2007; Mckenzie & Franke, 2009).

Taking into account the complexity and explosive development of these technologies, it seems necessary to support instructors in their use by conceptualizing educational and technological possibilities. There are different tools to represent and organize these knowledge items and we have selected conceptual maps (Novak, 1998) as one of the more flexible and powerful techniques to graphically sustain this process. This work discusses on the use of conceptual maps as tools to model both the instructional domain and the technology domain in order to provide instructors with guidelines to design and develop engaging and interactive Tablet PC-based learning scenarios.

The remainder of the article is organized as follows: section 2 introduces concept maps as a way to support instructors who plan to use these technologies to improve the classroom environment; section 3 describes the way the approach is been implemented and tested, and finally, section 4 draws some conclusions.

2. Supporting teachers to introduce digital-ink technology

This section describes our approach to support faculty who plan to use digital-ink technology to create more interactive and engaging classrooms. The first step in the proposed process is to develop a concept map representing the instructional model for the learning environment where the intervention is to be made. However, in order to facilitate the subsequent processing of the information contained in the maps, the different concepts of a rather generic instructional map were converted to questions, and a complete questionnaire was developed by listing these questions in the same hierarchical order as the concepts on the map from which they were taken. Then, the approach uses a concept map that was developed to give an overall concept of digital-ink technologies: their features and the types of devices that provide them, the operating systems that support them, the services they offer, and the associated software tools, among other aspects. The terminal elements of this map are related to the aspects of instruction that may be enhanced by them, as depicted in the Figure 1.
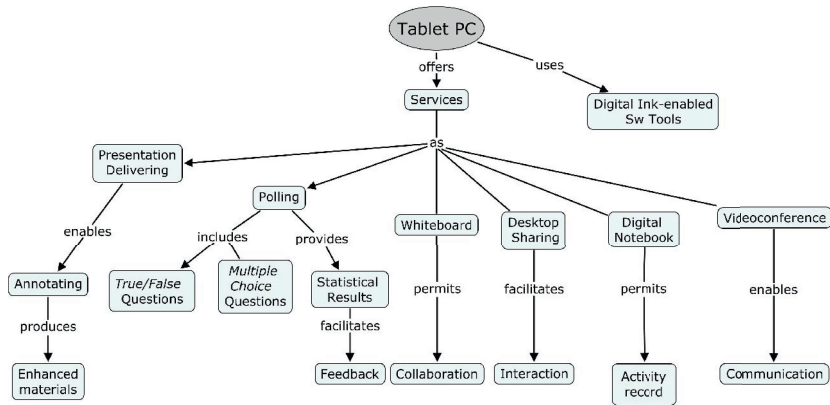
Fig. 1. Detail of the Tablet PC conceptual map concerning services.

Once the instructional and technological domains have been defined using the appropriate concept maps, the next step is to correlate them to each other. In other words, our proposal aims to infer information from the elements that make up the two concept maps (concepts and correlations) so as to give teachers some recommendations for using these technologies that have been adapted to their particular instructional approach, including specific examples of ink-enabled software tools.

3. Implementing and testing the approach

To validate the proposal described, a number of workshops were conducted during academic years 2010-2011, 2011-2012 and 2012-2013, in which teachers were given a presentation on the capabilities of digital-ink technologies and, at the same time, experimented with tablet PCs and other digital ink devices in a classroom configured for this purpose. More than 100 engineering professors participated in these workshops.

Before attending the workshop, participants were invited to answer a pre-questionnaire in order to obtain each one's particular instructional model.

Figure 2 summarizes the responses obtained on the pre-questionnaire from those who attended the workshops held during the last three academic years. The percentages shown are for certain questions only, those where these technologies have shown superior capabilities. There is a remarkably high number of professors who use digital presentations in lecture-based classes (95%); who support their content presentation with graphic elements such as diagrams, figures, and schematics (84%); and who incorporate an element of student classroom evaluation (64%). Teachers also commonly assign activities that make use of graphic elements (69%) or open response exercises (70%).
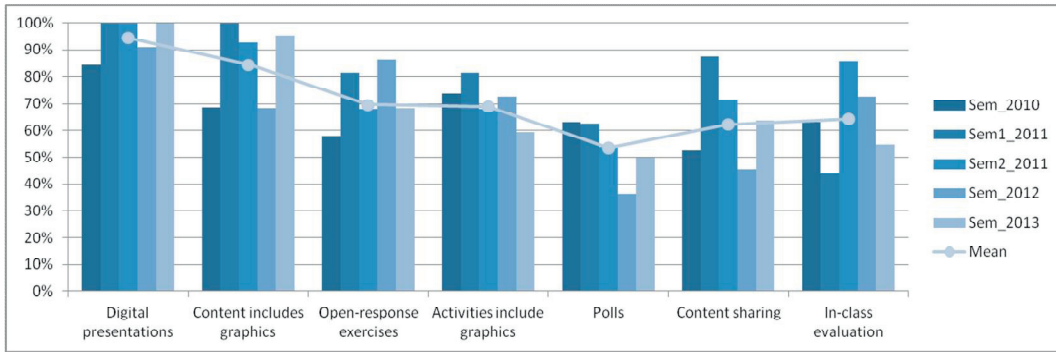
Fig. 2. Summary of Pre-Questionnaire Results.

Based on the instructional capabilities included on the aforementioned technological concept map and experiences with applying them in various disciplines, a list of good practices in using these technologies was drawn up. This list was used to produce a post-questionnaire on digital-ink technologies capabilities that was given to the workshop participants at the end of the workshop. In this way, and after experimenting with the technologies, they assessed the instructional capabilities of these devices in terms of suitability for their particular context.

Figure 3 summarizes the responses on the post-questionnaire. Firstly, is important to point out the high percentage obtained (above 83%) for all the dimensions analyzed, what confirms, from the point of view of the workshop attendants, the potential for improving those aspects. The percentages are particularly high for the ease of taking polls (94%), presenting ideas graphically (93%), performing tasks requiring graphic elements (91%), and evaluating students on class participation (86%).
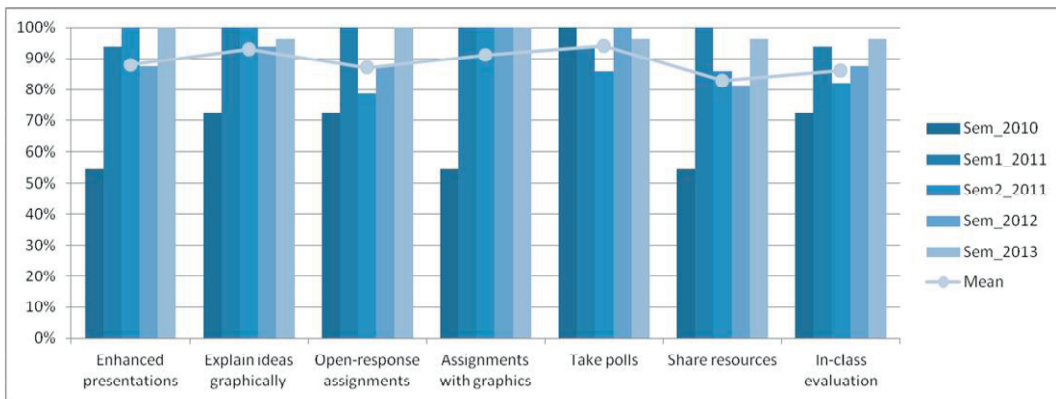

Fig. 3. Summary of Post-Questionnaire Results.

4. Conclusions

In this work we have presented an approach to support faculty who plan to use digital-ink technologies to create more interactive and engaging classroom environments. The proposal is based on the conceptualization of instructional and technology issues using concept maps to represent the corresponding knowledge. Starting from the learning requirements of a particular context and the educational potential of these technologies, instructors are provided with some guidelines that help them to properly develop new learning scenarios.

This approach has been applied in an educational technology-enhanced context based on digital ink technologies and several workshops have been developed. This approach implementation has enabled the detection of interesting connections between instructional and technological issues revealing the potential services provided by digital-ink technologies according to the proposed teaching guidelines.

Acknowledgements

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