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Use Of Tablet Pcs In Higher Education: A New Strategy For Training Engineers In European Bachelors And Masters Programmes

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Abstract

The use of technology in classrooms in Spanish universities has been following an upward path, and in many cases technological devices are substituting other materials that until now have been used, such as books, notebooks and so on. Step by step in higher education, more of these latest generation devices are being used, and are providing significant improvements in training. Nowadays, there are Spanish universities that use tablets, a device with multiple applications for teaching as well as for students to study differently. They are definitely a notable innovation that will gradually become incorporated into university life. Tablet PCs make teaching more dynamic and available to students through the use of up to date digital materials, something which is key in training engineers. This paper presents their different functions employed in three Spanish universities to support teaching in engineering degrees and masters using the tablet PC, and their impact on the training process. Possible uses in specific programs like the Erasmus Masters Programmes are also assessed. The main objective of using tablets is to improve the academic performance of students through the use of technology.

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1. Introduction

According to UNESCO, Information and Communication Technology (ICT) can contribute to universal access to education, equity in education, the delivery of quality learning and teaching, teachers’ professional development and more efficient educational management, governance and administration.

A tablet PC is a type of portable computer, larger than a smart phone or a PDA, with an integrated tactile screen to interact with fingers or stylus pen (passive or active), with no need for a physical keyboard or mouse. These are replaced by a virtual keyboard, and, in some models, by a mini trackball located on one side of the screen. They have been described as being halfway between a smartphone and a notebook. Tablets are more focused on the use of applications (apps) than on creating content. Their general use in the university environment should lead to an increase in the acquisition of both generic skills and professional ones, as well as encourage attendance and application to real-life case studies and problems. In some instances the use of tablets has been adopted as support in practical classes and in fieldwork, and even more as a tool for data acquisition and measurement. On the integration and use of tablets in the daily lives of Spanish people, a study by the International University of La Rioja (Redbility, 2013) should be highlighted. It identifies the time of the day when tablets are used in Spain, indicating that 30% of users use their tablets in the morning. Other findings of this study are that young people, between 18 and 24, are the most common users of this device, which is used mainly to communicate, either by email (95%) or through the various social networks (93%). This activity is followed, respectively, by playing games, reading online news, weather or travel-related information. The most downloaded apps are social networks (66%), games (59%) and utilities (58%). In addition, 33% of users stated, they used applications to download TV programmes for entertainment. This article aims to highlight the enormous potential of tablets in a classroom environment as an educational resource due to their versatility, portability and functionality.

2. Common applications used

The use of tablet PCs is still limited, but a significant increase is expected over the next 5 years. The basic ways that tablets can assist students are summarized as (MECD, 2011):

• Providing multimedia functions
• Providing Internet access options
• Managing calendar, contacts and events
• Note-taking or making drawings and graphics (Figure 1)
• Managing documents
• Supporting reading through e-reader applications

There are successful cases such as at the IE University, a private university located in Segovia and Madrid, which is undertaking an interesting experiment with students studying a Master in Architectural Management and Design in
which everyone must carry out activities on a tablet PC as their sole support. They are required to use the device to communicate with teachers and each other. They have to use it for taking notes and for its multimedia functions as all texts are in digital format, and tasks have to be uploaded to the virtual platform of the university. The Master is taught 70% online and the rest is face-to-face in Madrid and London, so the tablet is an ideal tool because of its portability. The results of this trial show that the average use of the device is 2.5 hours per day and the main activities in descending order are: online searches, reading PDFs, taking notes with databases, email access and wider social networks (reversing the usual order of activities mentioned above). Students already use technological tools like tablets and smartphones in their everyday lives, and, teachers are also gradually becoming more familiar with these devices. Another example of their use is in the studies of Geotechnical Engineering at the University of Alicante, where tablets and smartphones are used in three main ways:

- Using tablets in teaching in the classroom to solve problems through “my type PDF-notes”. Using this application and a stylus pen, teachers can write notes on the solution to problems in PDF format and through an RGB connection, they can project their notes onto a screen for students to see.
- Using tablets for fieldwork with three main functions. First, the tablet can be used in order to show students the theoretical aspects to be aware of when taking the *in situ* data. Second, it can be used as a tool to support the observed fieldwork, and finally as a measuring tool in practical classes of rock mechanics.

![Figure 2. Screenshots of the free apps (FalloutComp, ClinometerHd) used for the measurement of the strike azimuth (left) and the dip angle (right) of a discontinuity.](image)

Another application of tablets and smart phones for teaching engineering subjects is their use for measuring the orientation of discontinuities (i.e. the strike and the dip angle). For this purpose, students have to download free apps that allow the measurement of the strike and the dip angle (Figure 2) of a plane, and then place the device on the discontinuity to be measured. The main advantage is that most of the students have tablets or smart phones and, therefore, can practise taking measurements by themselves. Tablets can also used for explaining geological features in the field. In this case, the camera function of the tablet is used for taking a picture of the element under study (e.g. a fault or a specific stratum) and then used for editing, drawing and highlight the main properties of the element (Figure 3). Note that in the field, explanations are usually given by pointing out the different elements and properties that are considered important. In this case, the tablet is used to capture an image of the object under study and, then, used to highlight the key aspects to the students. This allows students to better understand which elements are being discussed and immediately to recognize them in the field. Note that a tablet allows the use arrows, lines, simple figures (e.g. circles) and even text; all of which help improve the explanation.
Tablets can also be used as a method of self-assessment for students, with students reporting back on their deficiencies in certain areas of knowledge and then receiving a series of recommendations to remedy misunderstandings. Another example is the MSc Programme in Climate Change and Restoration of Degraded Land, which focuses on new technologies and innovation in teaching with the development of a Virtual Learning Platform and the use of a tablet PC as a learning tool (Arraiza et al., 2012). Institutionally, the development of apps by universities, themselves, has been encouraged as a result of the incorporation of tablets in teaching. Study programmes are often promoted in social networks, and in the case of the Technical University of Madrid, with its app "UPM - Degrees from the Polytechnic University of Madrid", prospective students can find out about undergraduate degrees, programmes, courses, requirements, including the location of the Engineering Schools.

3. Conclusions

Today, new technologies can help sow the seeds of our knowledge society. Internet and the new digital era offer a previously unknown paradigm for all aspects of studying: universal knowledge and learning through e-learning systems with online learning through massive open online courses (also known as MOOCs). Initially, these new resources often try to resemble traditional ones: digital smart boards that are used like the classic ones on which we wrote with chalk, tablets used as workbooks or notebooks or as support for new digital books. Our target students already match the largest number tablet users: young people between 18 and 24 years old. This segment coincides with the majority of ages at which university graduate and undergraduate students enrol on courses. There is no doubt that one of the advantages of the tablet compared to a computer is its portability, its small size and weight make it very easy to carry almost anywhere without incurring any extra charges, as can happen with a laptop. Another interesting factor, from the technical point of view, is the fact that the battery lasts, in general, far longer than a laptop one. A tablet can last a whole day comfortably, while with a laptop this is difficult to achieve. Tablets can provide 10 hours of continuous and intensive use and if the time not using it is taken into account, 2 days’ battery life can easily be achieved, and, of course, it is usually cheaper than a laptop PC. Tablets also come in many sizes and shapes depending on our needs for capacity, performance, price, design, etc. Overall, the versatility of these devices means that, unlike computers, they can be used in many fields and situations in which a PC cannot. However, to fully integrate tablets in university curricula, it is necessary for teachers to have basic technological and pedagogical training in their use (Santamarta et al., 2012). It is also essential that they are integrated into teaching guides. That is, they must be used with a clear purpose, to achieve specific objectives in official programmes of educational institutions, not simply as way of improvising material. By themselves, they are not an asset to education; they are instruments that help to change and modify methodologies in the classroom. They enable immediate presentation of information; multimedia and interactive information; the connection between the learning environment and reality; implementation of cooperative activities and the development of cognitive skills. They also
allow students to acquire digital skills in the classroom, and integrate students into a 2.0 world, where they can exchange their teachers and traditional methodologies for technical resources that enhance motivation and learning. As for future lines of research, the effects of tablet PCs on the performance of students needs to be measured through surveys and students’ success and failure rates evaluated. It is also recommended that (i) universities, themselves, design their own applications, (ii) universities’ staff are involved in application development and (iii) the costs of integrating this technological tool are kept as low as possible. Finally, the use of tablets can contribute to achieving universal access to education, greater effectiveness of teaching and learning, as well as to the efficient management and administration of educational centres.

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References


