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On Reinforcing Learning in Engineering Education by Means of Interactive Pen Displays

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The use of traditional blackboards imposes several constraints in the learning experience, being the most relevant: 1) the unidirectional communication channel they provide; 2) their limited graphical possibilities; and 3) the impossibility of recovering the sequential flow of the lecture once it has finished. In engineering lectures, these constraints represent serious limitations. In order to overcome them, digital slides have been traditionally used. More recently, digital displays and tablets have been used to further improve the learning process.

Interactive Pen Displays (from Wacom manufacturer) are display devices with some particularities over Tablet PC's that naturally overcome most of these constraints. First, existing software provides endless display possibilities (geometric drawings, colors, simulations, graphs...). Also, not only the lecture results can be accurately recorded, but also the whole lecture process in its temporal dimension. This frees students from the tedious task of recording and taking notes and provides richer resources for their posterior autonomous work, as well as allowing recordings to be uploaded as learning objects to collaborative learning environments such as Blackboard or Moodle, for instance.

In this paper, the learning experience results from the application of the Interactive Pen Displays in Engineering-related lectures are presented. Specifically, results are provided for the topics of *Advanced Compilers Theory* in Informatics Engineering, *Introduction to Control Systems* in Electrical Engineering,

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and *Industrial Control Systems* in Electrical Engineering, Informatics Engineering, and Chemical Engineering. For the sake of generality, several professors and students in different courses have used the tool. We present the used methodology in the lectures, the results of questionnaires from the students and professors who participated in the study as well as the results from the publication of the session scripts and recordings in the learning platform. Results showed that 84% of students stated that the graphical possibilities of the device made the lesson easier, and 92% reported a positive assessment as complement for the learning process.

The use, benefits and limitations of alternative devices such as classic Tablet PCs are also discussed and compared to the Interactive Pen Displays. Finally, conclusions and further research lines related to the use of the tool are presented. ■

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