

# Abstract

Numerous studies show that ICTs can bring about major changes in the classroom, thereby easing some of the problems associated with the traditional, teacher-centered model of instruction. The personal computer's already numerous and unquestionable capabilities increase markedly when a special pen that produces digital ink—hence, the term pen-based technologies (PBTs)—is added as a component of the user interface. The tablet PC—a conventional portable computer with a screen that acts as a device for both presentation and data entry, —is among the leading devices that use this technology. These devices accept all types of strokes made by the user's hand, raised to the screen, for writing, drawing, creating schematics and diagrams, making sketches, expressing ideas visually—all in a manner similar to the way one would do it using pen and paper but with the additional advantages of the digital format.

Although there is an extensive literature describing experiences using these technologies in the scope of higher education, they in general lack a methodological approach that facilitates their successful integration. Thus, the main goal of this thesis is to develop a methodological approach that, starting from a particular instructional model, provides instructors with guidelines to incorporate pen-based technologies in a systematic way.

By making use of the ADDIE instructional design model as a reference, the procedures proposed are based on an initial modeling using concept maps of the various knowledge elements characterizing 1) the instructional approach for the course or training experience and 2) the technology to be incorporated—the PBTs, in our case. The matching process between domains is responsible for searching those relationships that makes possible to generate guidelines of how introducing the technologies. This proposal is complemented by the introduction of a catalogue of “digital ink” design patterns that working as mediating artifacts, synthesize what we consider good practices in using these technologies.

Our proposed methodology has been assessed by its main audience, both teachers and students. The results obtained in the numerous workshops for teachers, and classroom experiences in conventional groups, have shown that these proposals can be an effective way to integrate pen-based technologies in educational processes.