A Tablet PC-Based Learning Approach on a First-Year Computer Engineering Course

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Abstract

The era of communication technology has now a great impact in our daily lives. Learning approaches are now evolving from traditional slide-based lectures into much more dynamic ones, where technology plays a key role in order to improve the students' academic performance and engagement. In this paper, we propose a novel approach to develop interactive classroom environments supported by mobile Tablet PC technology, which integrates formative assessment into classroom practices and provides immediate feedback to students. We describe practical guidelines to design and develop both lecture materials and active learning exercises in the context of this next-generation technology.

1. Introduction

There are clear evidences that technology can drive major positive changes in the classroom addressing problems associated with traditional lecture-based pedagogy. In particular, the flexibility of Tablet PCs and other pen-based devices has the potential to achieve a wide range of educational goals and promote a more participatory classroom environment [1]. We could consider Tablet PCs as a hub for personalized learning both from the students' point of view and also from the instructor one.

2. A Tablet PC-based learning approach

Our proposal builds upon the fundamental issues related to our Computing undergraduate courses: (a) pupils' lack of motivation, (b) low class attendance rates; (c) high course dropout rates, (d) low participation and student interaction, and (e) eventually, poor students' performance.

Recent research demonstrates obvious advantages of using Tablet PCs in higher education. However, we think that any random implementation of educational technology has a low probability of success and widespread adoption. Thus, we consider that more concrete guidelines are required to develop and deploy such new technology settings.

The approach presented here is based on a teaching method that incorporates active learning techniques and supports in-class teacher/student and student/student collaborations. In this context, the instructor role deals with the development of contents and resources, adapted to a Tablet PC environment, the design of interactive activities that take advantage of these devices, as well as the use of quantitative and qualitative tools that enable a continuous student assessment. Next, the six steps that characterize the proposed approach are described.

Step #1. *To reduce slides content to the essentials in order to permit a dynamic adjustment of delivery and concepts.*

Instructors can connect the Tablet PC to a projector to display slides, while showing their handwritten annotations in real time. These materials can also be shared with the students, allowing them to personalize the instructor provided materials.

Step #2. *To design and develop specific add-value multimedia resources allowing students to gain a good level of understanding.*

The instructor's experience on the course will be very valuable to decide the topics to be covered: fundamental concepts but difficult to grasp, most frequent mistakes, complex algorithms and processes,

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software tools, laboratory equipment, etc. These resources should help instructors to regain/reset student attention during lectures.

Step #3. *To design and develop in-class individual and group activities in order to directly engage learners with the subject matter.*

In general, these class activities might involve: a) practice of some specific intellectual activity, e.g., analyzing, designing, testing, debugging, interpreting specifications, etc., b) applying specific knowledge, c) having students examine their own knowledge and understanding.

Step #4. *To introduce the use of discipline specific software and resources to tackle problems and/or projects in more realistic scenarios.*

The idea is to provide learners with the opportunity to employ tools such as Matlab, PSpice, LabView, etc., in a similar way to what practicing engineers in industry might have access to in their real environments. Sketching is also an important activity in the early stages of project-based approaches. Digital ink possibilities can also support each step of the idea generation process and thus, improving the efficiency of collaborative learning and teaching.

Step #5. *To design and develop one-minute papers that help instructors to gain knowledge about students understanding.*

Quick polls are very useful to gather formative information and in turn providing immediate feedback to students to clarify misconceptions. In the context of networked classrooms, presentation tools support these strategies in a very efficient way.

Step #6. *To design and develop assessment items in such a way that the overall content of the course can be covered.*

These items should be designed with different difficulty levels and approaches including, at least, questions devoted to recall of knowledge and application of knowledge (understanding). Tests will then be assembled from the appropriate assessment items and will facilitate instructors a quantitative continuous assessment.

3. Implementing the approach

In order to apply the former approach, both specific infrastructure and committed faculty members are essential.

In relation to the material resources, a networked Tablet-PC classroom together with the corresponding teaching platform is required. We have configured a wireless classroom equipped with 25 Tablet PCs for students and one additional for the instructor, which is connected to the data projector. All this equipment has been funded by Hewlett Packard as part of the award granted to our group, in the framework of the *2008 HP Technology for Teaching Grant Initiative, Transforming Teaching and Learning through Technology* [2].

Concerning the teaching platform, we have selected *Classroom Presenter* (CP), because it fits very well the different steps of the previously described approach. CP, is a Tablet PC-based classroom interaction system that supports the sharing of digital ink on slides between instructors and students to increase the instructor's flexibility while lecturing [3].

During this academic year, we have begun exploration of applying our approach in Computer Technology, a first-year Computer Engineering course. Several experiences have been also applied to other undergraduate courses ranging from Operating Systems to Local Area Networks.

4. Conclusions

In this paper, we have presented an approach to develop interactive classroom environments supported by mobile Tablet PC technology, which integrates formative assessment into classroom practices and provides immediate feedback to students. This approach provides some guidelines that we have implemented in a first-year Computer Engineering Course. The preliminary work has showed the potential of the proposed approach to enhance the students' performance and engagement.

5. References

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