Pedagogical Use of Tablet PC for Active and Collaborative Learning

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Abstract

In this paper we present our experience using Tablet PC to support the pedagogical needs of the engineering classroom as well as typical engineering group collaborative environments. We applied this novel active and collaborative learning framework to undergraduate students from a Fundamental Database course in order to analyze the role of pedagogical use of Tablet PC. Then, this educational test was satisfactorily received by students and conclusions deal with getting student assessment about their experiences in this experimental course and promoting use of next-generation pedagogical collaborative learning applications using Tablet PC as a presentation.

Keywords: Innovation in Education, Collaborative Learning, Active Learning, Tablet PC, Digital Ink, Presentation Technology, New Communication Media this presented process using Tablet PC as a presentation tool.

Introduction

Currently, the spectacular development of new technologies provides motivation for increasing emphasis on effective use of technology and on communication as an essential tool for management and innovation on education.[1]

Additionally, new devices like Tablet PCs are emerging as some of the most promising technologies, turning them into powerful educational units in ways never envisioned for many decades.[2-3]

As a result, we consider classroom education as a cognitive process that encompasses students, instructor, and collaborative tools.[4] What is more, interaction is an absolute prerequisite for meaningful and constructivist learning, i.e., students who engage and interact are more likely to build the personal knowledge structures necessary for their learning.

In this paper we present our pedagogical experience using well-known collaborative and active learning framework like Classroom Presenter.[5]

Consequently, we observed the classroom and then surveyed students who participated actively in order to learn about their experiences.

Our results informed the design and deployment of novelty collaborative learning technologies connecting students across active learning through extemporaneous teaching with a flexible presentation system. Therefore, this work reflects all this presented process using Tablet PC as a presentation tool.

Classroom Presenter as active and collaborative learning tool

In new educational contexts, digital ink technologies have evolved over time and include touch sensitive whiteboards, PDAs, Tablet PCs, and digital pens.

Then, learning systems using these technologies support note taking and sharing, real-time active collaboration through classroom presentation, e.g., integrating ink with prepared slides for lecturing.

Our motivation at this point dealt with how to promote the active and collaborative learning through the ability of an instructor to present lecture material from a Tablet PC. Concretely, we took the challenges of Classroom Presenter [5] based on Tablet PC [3] to support fluid discussion and flexible teaching styles as goals in developing new collaborative learning systems. Classroom Presenter
presents several improvements over traditional educational methods, e.g., supports real-time natural handwriting in addition to prepared lecture slides. Classroom Presenter uses a pen based computer as the instructor’s input device and supports writing on top of slides as well as writing on a separate whiteboard space. Actions (writing strokes, slide transitions) are multicast transmitted to student’s computers displaying the lecture presentation. Even also they could send feedback to the instructor from their devices in real time.

### Experiment

We used Classroom Presenter in a Computer Engineering Fundamental Database course. The local classroom was configured with laptops connected to a multicast enabled network. The room featured a large rear-projection display to project the instructor computer displays. As depicted at figure 1, the system setup consists of following minimum elements: (i) the instructor’s device, (ii) student’s device, (iii) multicast enabled network to connect such devices depicted as Classroom Presenter (CP) Instructor and CP Clients respectively, and (iv) a projector. The projection showed the lecture slides and any writing the instructor made on his Tablet PC was transmitted through multicast to the student’s devices. Besides, as depicted bellow in figure 2, instructor added real-time ink on his Tablet PC to highlight text, draw an illustration, or solve collaboratively any exercise with the class.

![Figure 1. System setup for collaborative and active learning framework](image1.png)

![Figure 2. Classroom presenter enables real-time inking.](image2.png)

Approximately 45 undergraduate students from Computer Engineering attended voluntarily during this pilot learning experience. During the lectures, due to technical reasons dealing with device’s availability, sets of three students minimum each were grouped in order to share a Tablet PC connected to the enabled multicast network (see figure 3). The instructor used prepared MS PowerPoint slides to present material each week using the Tablet PC device, i.e., writing extemporaneously text on slides, creating Relational Algebra diagrams. More to the point, to promote collaborative and active learning, Classroom Presenter also supports bi-directional sharing of information with student devices. That is, the instructor develops a slide-based lecture and includes a number of activities on the lecture slides like SQL proposed exercises to create a connection between the slide material and his oratory.

Therefore, as depicted next in figure 3, whenever an activity slide is reached, students work collaboratively and write their answers on that slide with digital ink and send the slide and ink back to the instructor.
Figure 3. Students working collaboratively

Then, instructor reviews the submissions and selectively shows some on the public projector display. This invaluable pedagogical tool allows the instructor to incorporate a diversity of ideas, show novel solutions, and discuss misconceptions illustrated by student answers.

The use of a public projector display also creates a focus of attention and provides a mechanism whereby student work can be integrated into the lecture discussion – one of the most powerful aspects of the student active learning process.

Next, we studied the qualitative nature of this presented experimental course through surveys given to students and observations of the class from learning site.

As a result, we collected observation notes and a period of time to analyze student’s feedback. The surveys asked questions to reveal student’s thoughts about the interaction levels, their level of engagement with the course, their satisfaction with the learning framework, and their satisfaction with the presentation technology.

Analysis of our results for this experimental course is discussed deeply through next section.

Analysis of results

Overall, surveyed students responded very actively to the survey so on the whole their reactions to this innovative collaborative learning system were well received. What’s more, they generally thought that use of Classroom Presenter had a positive effect on their learning experience. Next, table 1 shows items used for student survey process during Fundamentals Database course. Concretely, students were asked about their reactions to the use of Classroom Presenter.

As depicted next, available answers were ranked as follows:

(i) “Less” to mark a minor grade of impact in comparison with traditional teaching method received until now,

(ii) “Indecisive” means no changes or that student was unable to make a firm decision and

(iii) “More” was characterized to make a positive assessment about impact on this item.

Next, figure 4 depicts results dealing with student responses. Results are showed as percentage from 0 to 100%. We checked that some results coincided with our observations of the class during the use of this learning framework although we had a number of surprises from our initial expectations.

Table 1. Survey Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Available answers</th>
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<tbody>
<tr>
<td>1. Which was your attention grade to the lecture?</td>
<td>Less / Indecisive/More</td>
</tr>
<tr>
<td>2. Which was your grade about understanding of material?</td>
<td>Less / Indecisive/More</td>
</tr>
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<td>3. Which is your grade about encouraging the use of this</td>
<td>Less / Indecisive/More</td>
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<tr>
<td>collaborative learning framework?</td>
<td></td>
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<tr>
<td>4. Would greater flexibility to annotate/highlight slides be</td>
<td>Less / Indecisive/More</td>
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<td>useful?</td>
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<td>5. Would you prefer to give a whiteboard style of lecture?</td>
<td>Less / Indecisive/More</td>
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<td>6. Which is your grade about writing text on the slide?</td>
<td>Less / Indecisive/More</td>
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<tr>
<td>7. Which is your grade about drawing diagrams on the slide?</td>
<td>Less / Indecisive/More</td>
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<tr>
<td>8. Which is your grade about writing SQL example code on the slide?</td>
<td>Less / Indecisive/More</td>
</tr>
<tr>
<td>9. Which is your grade about using this learning framework</td>
<td>Less / Indecisive/More</td>
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</table>
to interact with instructor in real-time?

10. Which was your grade about using real-time video through this learning framework?

<table>
<thead>
<tr>
<th>Grade About Using Real-Time Video</th>
<th>Less / Indecisive</th>
<th>More</th>
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</table>

Figure 4. Students’ survey responses

Thus, about using this collaborative learning scenario, 81% of the respondents said it increased attention, 7% said it had no changes in attention and 12% said minor. We considered that use of the tablet presentation system in this experimental course had a positive effect on attention to lecture. Moreover, more than 50% of students (item 2) felt understanding material lecture was easier and effectively item 3 shows this consideration with 82% encouraging the use of this collaborative learning framework. On the other hand, 75% said it increased grade of flexibility to annotate/highlight slides, 0% said it had no changes and 25% said minor. At this point, we observed many classes where between 70 and 90 percent of the slides were real-time inked using different pen colors. However, item 6 discovered 43% and 43% said major or minor impact grade about writing text on the slide, respectively. Thus, e.g., we observed a lower positive impact (62%) on item 8 about writing SQL example code on the slide. In this case, our conclusion was that classroom lectures on Tablet PC offer interesting challenges for handwriting recognition because perhaps slides were hastily written due to several reasons like: (i) Instructor was too concentrated on speaking or (ii) too much time between the written and spoken word so ink didn’t provide a concrete link between speech and slide. Nonetheless, item 5 showed that 82% of students didn’t prefer the whiteboard style of traditional lecture. Finally, item 9 shows that 68% of the respondents said it increased real-time interaction with the instructor, 7% said it had no changes in attention and 25% said minor.

Again, we considered that use of the tablet system had a positive effect on active and collaborative learning. Also, item 10 shows this consideration with 93% encouraging the use of real-time video through this collaborative learning framework. Then, we considered that respondents were very encouraging of this system’s future use in a distance learning course.

Conclusions and work in progress

In this paper we have described a novel learning scenario that enables active and collaborative learning activities using Tablet PC as a presentation tool. During the lecture the instructor adds real time ink to the slides, and at various points students are asked to solve collaboratively. Then, this educational experiment has promoted use of next-generation pedagogical collaborative learning applications and even also offered new solutions to teach using Tablet PC. Our work in progress deals with (i) studying pedagogical use of multicast video streaming [6] including support for wired and wireless classrooms within distance learning environments and (ii) studying more complex capabilities in order to develop novelty HCI-based interfaces i.e., using new wireless communications interface methods [7].

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References


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Francisco Nortes is concluding his B.Sc. in Computer Systems Engineering from Miguel Hernandez University of Elche through 2006 where he is developing his Final Project. He is a C++ expert and designer of e-learning interfaces working at present in the Software and Computing Systems department of Software Company. His research contribution focuses on deployment of new collaborative methodologies dealing with innovative education and afterwards studying impact on traditional educational theories and practices offering several benefits to students and faculty staff.