Tablet PC Application in Geotechnical Engineering

Amin Chegenizadeh[1+], Hamid Nikraz [2]

[1] Curtin University of Technology, Perth, Australia

[2] Department of Civil Engineering, Curtin University of Technology, Perth, Australia

Abstract. The use of PC in education and training dates to the early 1940s, when American researchers developed flight simulators which used analog computers to generate simulated onboard instrument data .This paper studied use of Tablet PC on student learning and their satisfaction from a case study of geotechnical engineering tutorial. The paper concludes that usage of tablet PC increased the student engagement and productivity in the tutorial class. Finally, the satisfaction is presented graphically.

Keywords: Geotechnical, Teaching, Tablet PC

1. Introduction

Developments in technology have made variations on educational environments and applied new approches to applications of learning-teaching attitudes. Educational process needs more than traditional instructor and student-teacher roles become altering eventually. Student becomes learner and his/her role is going to be dynamic thinker rather than passive listener, while teacher becomes guide to lead learner to related information, define needs and expectations of students, then help them to find and use knowledge/information. In large scale geotechnical engineering classes and tutorials, lecturer usually adopt a teaching method in which students passively listen to material presented sequentially with infrequent class discussions, activities, and assessment. Past research (Felder *et al.* 1988, Felder *et al.* 2005) has shown, however, that this conventional teaching method is ineffective for engaging many students' innate learning styles, leading to students' poor comprehension of the course content. Instructors of both large and small engineering classes also rely heavily on presenting digital information, such as pictures, videos, data, movies, and websites. To present this data, lecturer usually: (1) rely solely on the use of digital slides (e.g., Microsoft® Office PowerPoint), or (2) switch back and forth between writing on the blackboard and using a dropdown projection screen. The single use of digital slides significantly restricts the instructor's flexibility during the lecture and often leads to a passive, static teaching style. In the case of employing both the blackboard and digital slides, the text written on the blackboard is often difficult to see or interpret by students, and transferring between the blackboard and digital slides is slow and time-consuming. Research has shown that both of these approaches are often ineffective in maximizing student engagement and students' subsequent comprehension of the lecture material (Chegenizadeh and Nikraz, 2012, Brophy *et al.* 2005, Toto *et al.* 2006).

The aim of this paper is to present a teaching method that overcomes the primary common deficiency of typical engineering instruction, namely, ineffective engagement of all students' innate learning styles due to passive-static or distracting presentation of digital information in the tutorial. A teaching method for large engineering classrooms that integrates a classroom communication system (CCS) and tablet PC (TPC) are usually applied to create a learning environment in which: (1) all students' innate learning styles are engaged using a variety of teaching techniques, and (2) the lecture is continually controlled within a single platform, seamlessly integrating writing, digital information, class discussion, and evaluation of students 'understanding of the presented lecture. Richard et al (2010) firstly, examine the implementations of the CCS and TPC, as well as a model used to recognize and describe students' learning styles and teaching styles, will be described. Subsequently, the teaching method was presented, including a explanation of the activities during the lecture period and details of how the CCS and TPC are integrated. This was followed by a

description of teaching techniques that were used in the lecture period to engage students' innate learning styles. The geotechnical engineering classes where this teaching method was implemented were described, and the methods used to assess this teaching method were discussed. Results were then presented with evaluation of the effectiveness of this teaching method. Guidelines to assist others in implementing the teaching method were also set forth, followed by the conclusions. (Richard et al., 2010)

In recent researches, Tablet PC (TPC) caught attention of education researchers to engage students and effectively presents various forms of data and digital media (Brophy et al. 2005, Toto et al. 2006). In general, a TPC is a small, portable personal computer with a screen on which the user directly writes with a special TPC pen. With application of TPC student can view lecture note instantly, in the instructor's natural handwriting, on a screen. A variety of teaching methods have been successfully used with the TPC. Frolik et al. (2004), Brophy et al. (2005), and one of the two instructors in Toto et al. (2006) used the program Microsoft® Journal on the TPC to present the course material as they would on a blackboard, writing on the tablet what they would write in chalk on the board. Russell et al. (2007) and the other instructor in Toto et al. (2006) used gapped notes or "skeleton notes" on their TPCs, with only the instructor in Toto et al. (2006) using Microsoft® Office PowerPoint. In both of these teaching methods using the TPC, instructors are capable to reach digital information. In the case of skeleton notes, the notes are embedded with digital media, figures, and data a priori, but key conceptual information is eliminated. Instead of having students writing down all of the data presented during the lecture by hand like teaching with chalk and a blackboard, the students and instructor complete the skeleton notes together throughout the lecture (students complete the distributed notes by hand while the instructor completes them with a TPC)(Richard et al,2010) . This shifts the students' attention from copying notes as a means of archiving lecture content to working with the instructor and other students to develop the course notes (Toto et al. 2007). Regardless of whether the TPC is used as a digital blackboard or to complete skeleton notes, feedback for course evaluations suggests that students prefer the instructor to teach with the TPC rather than with other, more conventional, methods (Toto et al. 2007).

2. Teaching Method

A teaching method was developed to create a classroom environment where a variety of teaching techniques are used to engage all students' innate learning styles and a TPC is used to dynamically control the lecture sequence, seamlessly integrating writing, digital information, class discussion, and student assessment. (Chegenizadeh and Nikraz,2012) This section first describes how TPC is used within a lecture period and then presents teaching-style techniques that the instructor can use in the lecture period to encourage learning in students' innate learning styles.

According to Chegenizadeh and Nikraz,2012 ,the Tablet PC is typically used in the classroom as a presentation device that takes the place of the blackboard. Video is output to a screen using a data projector. With products such as Microsoft OneNote, PowerPoint, or Journal, an instructor has the ability to prepare lecture material in advance or write "on the fly" during class as one would write on a blackboard. The latter is particularly useful for material that requires interaction – e.g. illustrating how to solve equations or demonstrate dynamic processes that may be difficult to prepare in advance through a medium such as PowerPoint. It is also easy to switch between other computer applications – e.g. a web browser, telnet, or an integrated developer environment. A number of universities have adopted pilot projects to investigate the efficiency of Tablet PC's. For instance, Notre Dame and Seton Hall University have put Tablet PC's into the hands of faculty to evaluate their impact as a teaching tool. Bentley College distributed Tablet PC's to students . MIT students used Tablet PC's to creatively and collaboratively design robots for the International Design Contest . Individual faculty at numerous institutions have also used Tablet PC's to deliver their courses.(Kenrick Mock,2005*)*

3. Experience with Tablet PC in tutorial classes

A series of tutorial session were conducted using Tablet PC method to teach student. This study focuses on Geotechnical Engineering tutorial class. As previous research by authors, at end of every three sessions,

feedbacks were taken from students to maintain quality of teaching high. The final mark of this course was compared in results section to give better understanding.

The major use of the Tablet PC in this course was to substitute the blackboard with the Tablet PC. Usually, the usage of Tablet PC can have below advantages (Kenrick Mock,2005)

- The lecture can be conducted entirely by drawing in digital ink without preparing material in advance, as is necessary with PowerPoint. Alternately, material can be prepared in advanced and annotated during the lecture.
- The instructor can easily re-display previously covered material that would normally have been erased on a blackboard.
- Convenient access to multiple pens in different colors, widths, and styles
- Easy to switch to other applications (e.g. telnet, web browser, IDE)
- Digital ink can be saved and viewed later through a web browser.
- By standing off to the side, the instructor never occludes the screen and can maintain eye contact with the audience while lecturing.
- No messy chalk or nasty fumes from dry erase markers.

4. Results

The results proved that using Tablet PC increased the satisfaction of student. Figure 1 shows the answers of student to the specific question related to using TPC as teaching method. Figure 1 shows that from 74 students in class, the majority agreed that TPC method in teaching has preference over traditional teaching. However, some students preferred to go through traditional method of teaching without using tablet pc. The main reason concluded to be dependent on number of slides for presentation and also problem type (i.e mathematical expression and normal text). Figure 2 demonstrate the comparison of final marks due to PC method and traditional method.
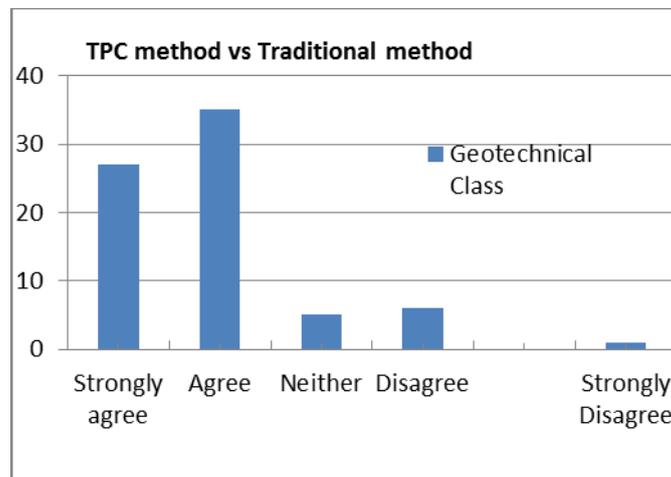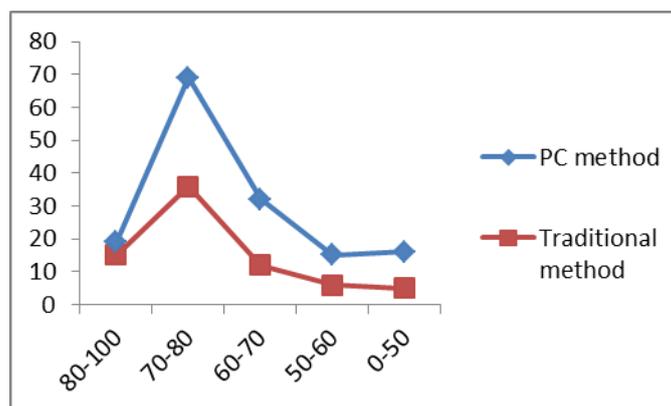

Fig.1. TPC method over Traditional method

Fig.2. Comparison of traditional method and PC marks

5. Conclusion

This paper focused on investigation on usage of Tablet PC on teaching and learning of student. The paper reflects feedback from students of a geotechnical tutorial class regarding usage of TPC for learning. The results proved that majority of student were happy to use TPC method as they could follow up the course easier than traditional and can concentrate more than traditional method.. The final marks of this course were compared and showed the students results is better than that of without TPC.

6. References

[1] Anderson, R., et. al. (2004). Experiences with a Tablet PC Based Lecture Presentation System in Computer Science Courses. In Proceedings of SIGCSE '04, Norfolk, Virginia March 2004. ACM Press.

[2] Clark, C. (January, 2004). Notre Dame Tablet PC Initiative. Retrieved 3/10/2004 from http://www.nd.edu/~learning/tabletpc/

[3] Felder, R. M., and Silverman, L. K. 1988. Learning and teaching styles in engineering education. Journal of Engineering Education. 78(7): 674-681.

[4] Felder, R. M., and Brent R. 2000. Effective teaching. North Carolina State University.

[5] Felder, R. M., and Spurlin, J. 2005. Applications, reliability, and validity of the index of learning styles. International Journal of Engineering Education. 21(1): 103-112.

[6] Frolik, J., and Zurn, J. B. 2004. Evaluation of tablet PCs for engineering content development and instruction. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition. American Society for Engineering Education.

[7] Lowe, P. (March, 2004). Bentley College students evaluate Tablet PCs. Retrieved 3/10/2011 from http://www.hp.com/hpinfo/newsroom/feature_stories/2004/04bentley.html

[8] Microsoft Corp. (November, 2002). Massachusetts Institute of Technology Changes the Face of Education using Tablet PCs. Retrieved 3/10/2011 from http://www.microsoft.com/resources/casestudies/ShowFile.asp?FileResourceID=1196

[9] Microsoft Corp. (April, 2004). Future Professor Puts Note Taking to the Test Retrieved 5/25/2011 from http://www.microsoft.com/Education/StefanucciFeature.aspx

[10] Mock, K. (2003). The Development of a CS0 Course for Distance Delivery. The Journal of Computing Sciences in Colleges, 19 (2), p. 30-38.

[11] Richard, Jason T. DeJong, Nicholas J. Yafrate, Engaging students with diverse learning styles in large, media-intensive geotechnical engineering classes using an integrated Tablet PC – Classroom Communication System platform,EJGE journal, 2010

[12] Simon, B., et. al. (2004). Preliminary Experiences with a Tablet PC Based System to Support Active Learning in Computer Science Courses. In Proceedings of SIGCSE '04, Norfolk, Virginia March 2004. ACM Press.

[13] Toto, R., Wharton, M., Cimbala, J., and Wise J. "One Step Beyond: Lecturing with a Tablet PC," Proceedings of the 2006 American Society for Engineering Education Annual Conference & Exposition, 2006. American Society for Engineering Education.

[14] Wachsmuth, B. (September, 2003). SHU Tablet PC Project. Retrieved 3/10/2011 from http://www.cs.shu.edu/tabletpc/