An Investigation into the Use of Interactive Technologies in Teaching Quantitative Courses

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Abstract

This paper presents the findings of an investigation into the use of the latest interactive technologies for teaching in the classroom. Two leading technologies were adopted, used and tested by the author for teaching of two different quantitative courses in a Business undergraduate program at the University of Southern Queensland (USQ) in Australia in 2005.

These state-of-the-art systems included Classroom Performance System (CPS) by eInstruction (www.eInstruction.com) and TurningPoint by Turning Technologies (http://www.turningtechnologies.com). Both systems allow students to provide responses in an anonymous manner. Hence, students are protected from feeling uncomfortable or embarrassed about giving incorrect answers. As a result, student participation in discussions and class activities is further encouraged and all students become active members of the session.

Survey results on students' perceptions and their performance in the assessments have demonstrated the effectiveness of these interactive technologies in classroom teaching.

Key words: Interactive, Clickers, Classroom Performance System, TurningPoint

Introduction

Classroom teaching has gone through significant changes over the years. The modern computers have certainly contributed to this evolution. We have moved away from a situation where the instructor would turn his/her back to the audience and fill the board with all sorts of information such as mathematical equations and expressions. Over the recent years, we have gradually introduced computers into the classroom. Towards the end of the previous century computers became much more interesting by adding sound and image to information. Hence, the modern classrooms started taking advantage of the multimedia systems. Presentation systems such as Microsoft Powerpoint have made a significant contribution to development of multimedia slide presentations in the classroom.

The trend with regard to the use of technology has continued and now the Internet is also accessible in many classrooms. As a result, the instructor has the ability to act as an interface between the students and a mine of information out there. This information is provided to the students in an interesting and colourful manner, usually, on a large screen. We are now entering a totally different era by adopting the latest interactive classroom teaching. Bringing interactivity into the classroom would help students to concentrate longer and get the feeling of session ownership. In other

words, the instructor will no longer be the only active member of the class who stands in front of the audience and does most of the talking, showing, writing and changing. The students can also become actively involved in making contributions; and remain alert and awake throughout the session. It is noteworthy to mention that this kind of interactivity may also be achieved with traditional and non-technology based means. Unfortunately, maintaining anonymity and protecting students from embarrassment can be quite challenging in a direct interaction situation. For instance, a lecturer can interact directly by asking students to answer question during the session. However, the inability to provide the correct answers may make the students feel uncomfortable for the rest of the session.

The author has had the opportunity of adopting and testing two of the leading interactive systems in the quantitative Business courses at the University of Southern Queensland (USQ) in Australia. This paper investigates the effectiveness of this kind of technology and provides a comparison of the features of these systems. The systems used included Classroom Performance System (CPS) by eInstruction (www.eInstruction.com) and TurningPoint by Turning Technologies (http://www.turningtechnologies.com).

Both systems are the state-of-the-art in bringing full participation and interactivity to the classrooms. Students are provided with handsets (clickers) which are used to respond to questions provided by the teacher. The correct answers to questions along with the results are shown immediately on the screen without identifying individual students. The system also presents the percentages of the responses in the forms of Histograms or Pie Charts. The interaction is carried out in an anonymous manner which encourages full participation.

These technologies encourage all students to participate in discussions. Students who are not sure about the right answers would be able to participate without being recognized and embarrassed. Students who know the correct answer will receive the confirmation about their response. Hence, they will be further motivated. After all, young people are now growing up with all sorts of gadgets such as mobile phones and other electronic devices around them. They are very much accustomed to pressing buttons on keypads. It may sound ironic but the interactive systems allow students to carry on with their habits in the classroom in a productive manner by pressing the keys on the clickers. These key pressings provide them with the feeling of being actively involved in the session. In other words they would become an active member of the session and participate in choosing the direction of the discussions.

CPS is designed to be used in conjunction with the Web as the registration is done and controlled by the system's website. As reported by Hafner (2004) Paul Caron uses CPS in his law classes at the University of Cincinnati to break through the "cone of silence".

The TurningPoint software is based on Microsoft Powerpoint. After the installation of the software, an additional toolbar appears on the Powerpoint screen. By using MS Powerpoint it would be possible to incorporate ordinary slides into the Turningpoint slides. These slides can be used for the purposes of providing guidance and explanation before a question and feedback after the question.

With TurningPoint, the students' feedback along with the generated graphics (bar and pie charts) can be saved as a session slideshow. These session Powerpoint slideshows can be later sent to distance education students.

It is also possible to have multi-level questions. In other words, a question is asked without attaching values to each option so that the students can see the audience's response and then the feedback with further guidance can be provided to students to help them move toward finding the correct answers. Finally, the same question can be asked by adding values to the options by nominating correct and incorrect choices. Hence, distributions depicting the percentages of correct and incorrect answers would be plotted by the software.

Implementing the Technology in the Classroom

The interactive technologies (CPS and TurninPoint) were adopted and tested by the author in teaching Management Science (an introductory course on Business model building applications) and Business Forecasting (an introductory course on methods and techniques of forecasting) at the University of Southern Queensland, Australia in 2005. These technologies were used to:

1. Test the students' understanding for the topics presented in the session.
2. Motivate and generate discussion based on class opinion during the session.
3. Guide students towards identifying appropriate factors for solving case studies.
4. Assign tests and quizzes at appropriate stages of the course to assess progress.

The following methodology was developed to utilize the system in a constructivist manner:

1. Present a case study.
2. Provide the necessary guidance.
3. Receive feedback from students.
4. Initiate discussion based on the feedback.
5. Allow students to develop solutions.
6. Receive feedback from students based on their solutions.
7. Initiate Discussion based on the Feedback.
8. Recommend the final Solution.

It should be noted that under constructivism, the learner is guided to find the solution by constructing his/her own understanding. Obviously this process is assisted by the teacher's guidance. An interactive system such as CPS can be utilized to provide the necessary guidance in a multimedia manner. It should be noted that a rich learning environment such as an interactive multimedia would satisfy a major objective of the constructivist approach (Phillips, 1998). See Bruner (n.d.), Dougiamas (1998) and Mahoney (2004) for some examples of introduction to constructivism. Figure 1 is a graphical representation of the constructivist approach to utilizing CPS.
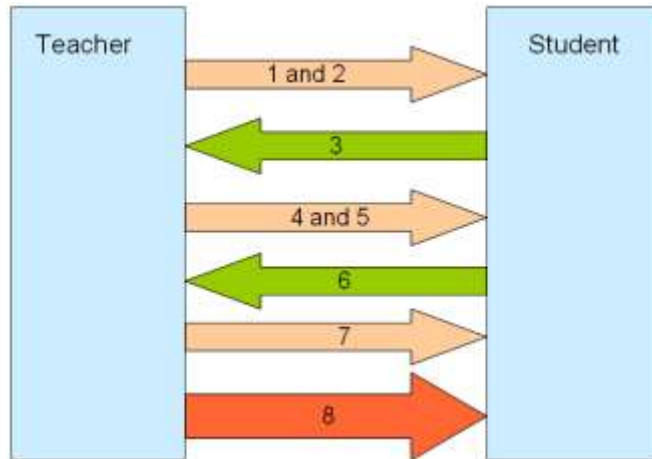
Figure 1 – Graphical Representation of the Constructivist Approach

In addition to case studies, quizzes with specially chosen images were also used with. These images were, in an entertaining manner, associated with the question and/or expected answer. See Figure 2 for an example which was developed and used with CPS. This approach proved to be successful due to the fact that the majority of the students are inclined towards visual style of learning (Nooriafshar and Maraseni, 2005).
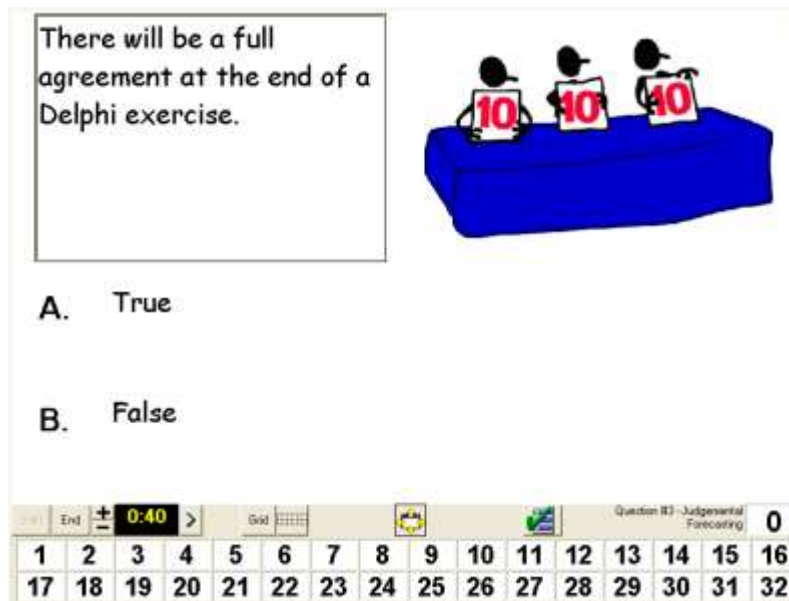

Figure 2 – Screen Shot of a Quiz Question with the Associated Image

Students' Perception of the Interactive Systems

At the time of feedback data collection, 15 students who were in possession of the CPS handsets agreed to participate in the survey. The initial findings have confirmed that Classroom Performance System is regarded as an effective teaching and learning environment. See Figure 3 for a summary of the results (as generated by CPS) on the following six questions:

Please indicate your answer to the following questions on a scale of 1 to 5

(1=Strongly Disagree, 2=Disagree, 3=Neither Agree or Disagree, 4=Agree, 5=Strongly Agree):

1. I enjoyed my experience with CPS
2. CPS contributed to the speed of my learning process.
3. CPS made my learning experience easy.
4. The interactivity provided by CPS made the sessions more interesting.
5. CPS allowed me to participate in answering questions without being embarrassed.
6. I would very much like to have CPS incorporated into my learning materials.

Opinion Survey
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Session: CPS Survey
Class: Business Forecasting

Question:	N/A	A(1)	B(2)	C(3)	D(4)	E(5)	Total
1	0 (0%)	0 (0%)	1 (6%)	0 (0%)	6 (33%)	11 (61%)	4.50
2	0 (0%)	0 (0%)	0 (0%)	3 (17%)	10 (56%)	5 (28%)	4.11
3	0 (0%)	1 (6%)	1 (6%)	5 (28%)	8 (44%)	3 (17%)	3.61
4	1 (6%)	0 (0%)	1 (6%)	0 (0%)	2 (11%)	14 (78%)	4.71
5	1 (6%)	1 (6%)	0 (0%)	2 (11%)	5 (28%)	9 (50%)	4.24
6	0 (0%)	0 (0%)	0 (0%)	2 (11%)	8 (44%)	8 (44%)	4.33

Figure 3 – Students' Feedback on Classroom Performance System (CPS)

As the feedback illustrates, most students who participated in the survey, agree that this way of conducting face to face sessions has advantages. For instance, almost 80% of the students strongly agreed that the interactivity provided by this way of learning made the sessions more interesting. Approximately 80% agreed (or strongly agreed) with the fact that CPS allowed them to participate in answering questions without being embarrassed. The results also suggest that 88% of the participants would very much like to have CPS incorporated into their learning materials. Therefore, the latest technologies in educational products can make a valuable contribution to effective teaching and learning. This is achieved bringing interactivity into the classroom and encouraging students to participate fully in all discussions and activities.

In addition to the above findings, the class attendance was also maintained at a high level throughout the semester. Every piece of assessment was undertaken and passed by the students. All the students (100%) sat and passed the end of semester formal examination. The performance and assessment participation was certainly superior to the external students who took the same course in the distance mode. It should be noted the two groups (internal and external students) have had almost identical performance and assessment participation rates in the past.

TurningPoint was also tested in a classroom environment by adopting a very similar approach as in the CPS experiment. The chosen course was Management

Science (an introductory course on Business model building applications). This time also 15 students participated in the study. Each student was provided by the TurningPoint keypad. Figure 4 shows the students feedback as bar charts for each of the six questions above as generated by Audience Response System.
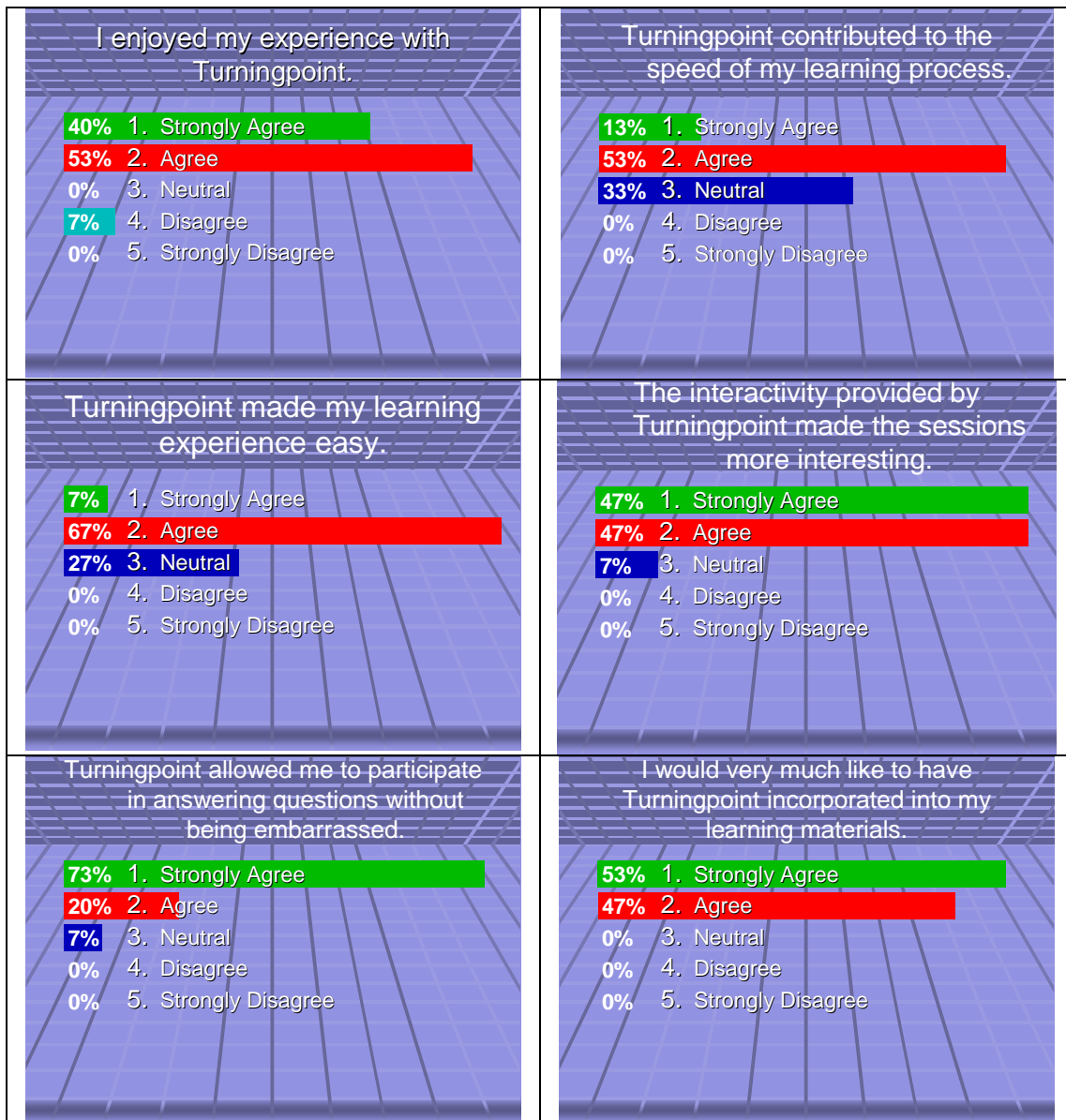

Figure 4 – Students' Feedback on Turningpoint

As the results clearly indicate a very large proportion of the students (93%) indicated their agreement (strong or very strong) with enjoying the experience. Well over 90% (94%) of students either agreed or strongly agreed that the interactivity provided by the system made the sessions more interesting. This result is comparable with the Business Forecasting students who happened to have more emphasis on the strongly agreed choice.

Conclusions

The two leading technologies of Classroom Performance System and TurningPoint were put to the test by adopting and using them with two groups of Business undergraduate students taking quantitative courses at the University of Southern Queensland in Australia in 2005. In both cases, a very large majority of the students (at least 80%) agreed that the interactivity provided by these technologies allowed them to participate in answering questions without being embarrassed. Almost 90% of the participants would either agree or strongly agree with having these technologies to be incorporated into their learning materials.

Therefore, as demonstrated, the latest technologies such as Classroom Performance System and TurningPoint can certainly assist in teaching and learning. It is envisaged that the applications and effectiveness of these technologies for teaching other quantitative courses will be further investigated in the near future.

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