

*This issue of CDTL Brief features three **Teaching Enhancement Grant** projects by colleagues from various departments and faculties.*

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An Integrated Simulation Problem-based Learning Activity

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The Alice Lee Centre for Nursing (ALCNS) at NUS uses the problem-based learning (PBL) approach for its undergraduate nursing programme. ALCNS has been keen to integrate simulation technology into PBL to provide opportunities for nursing students to apply theories learnt from the PBL session to real life situations. The main focus is to develop students' clinical competency in providing safe, competent, timely and appropriate patient care during crises.

Nurses need to be competent in identifying patients at risk and implementing immediate interventions to manage crises. Although the clinical laboratory and clinical practicum in the preregistration nursing curriculum provide nursing students with valuable learning experiences, they may not be exposed to clinical crises during such sessions. Technological advancement in nursing education has allowed the use of a human patient simulator, which is able to simulate a variety of patient conditions and create opportunities for students to learn how to manage an unexpected situation in a planned and prescribed way. One of the major strengths of simulation-based learning is that

it provides students with hands-on practice in solving 'real life' problems without the fear of harming a 'real' patient.

With the support of CDTL's Teaching Enhancement Grant, a quasi-experimental crossover study was conducted to evaluate the use of a simulated learning activity in teaching nursing students how to identify and manage a crisis. It was hypothesised that the clinical performances of nursing students who had experienced a simulated learning activity during PBL discussion would be superior to those who had only completed conventional PBL discussion.

First year nursing students in the Bachelor of Science (Nursing) programme, who undertook a nursing module on caring for patients with respiratory and cardiovascular disorders, were assigned to either a simulated situation with problem-based discussion (SPBD) or problem-based discussion (PBD) group for their PBL scenarios on respiratory and cardiac cases. Both SPBD and PBD groups worked on the scenarios in a 2-hour brainstorming session where students attempted to identify clinical

problems and develop hypotheses and learning issues through group discussion. Students then had time for self-directed learning to research their assigned 'learning issue'. Group members reconvened during the following week to re-examine the scenarios. The PBD group discussed their learning issues and information to resolve the crisis presented in the scenarios. SPBD students reconvened and went through a hands-on session to manage the crisis using the high-fidelity SimMan patient simulator. This was followed by a debrief in which students discussed findings from the individuals' learning issues and how the situation might have been managed more effectively.

Following the completion of each case scenario, students were invited to sit for a test on systematic assessment and management of a simulated patient in a crisis. A total of 30 nursing students participated in the first test related to a respiratory scenario and 33 nursing students participated in the second test related to a cardiac scenario. Their performances were scored using validated checklists. The mean scores of students who had gone through SPBD was significantly higher than those who went through the PBD (see Table 1).

Table 1. Comparison of post-test scores for SPBD and PBD group

Scenario 1: Respiratory Distress (n = 30)						
	SPBD Group		PBD Group		T	P
	Mean	SD	Mean	SD		
Assessment Score	8.83	0.83	8.19	1.28	1.52	0.14
Immediate Action Score	11.25	1.71	9.82	2.04	1.98	0.05
Overall Score	20.08	2.02	18.19	2.64	2.07	0.04*
Scenario 2: Chest Pain (n = 33)						
	SPBD Group		PBD Group		T	P
	Mean	SD	Mean	SD		
Assessment Score	8.44	1.34	6.93	1.16	3.43	0.00*
Immediate Action Score	17.44	1.92	14.60	2.06	4.1	0.00*
Overall Score	27.56	2.15	23.07	2.69	5.34	0.00*

* p < .05

The study supports the use of simulation with problem-based discussion as a more effective way of teaching students how to identify and manage a crisis as compared to the use of problem-based discussion alone. There are several reasons the integration of simulation into problem-based discussion results in superior learning outcomes. One is that simulation provides learners with an opportunity to practise their clinical skills in a realistic and non-threatening environment. This allows them to review and practise their skills as a whole and develop a systematic approach to crisis management (Weller, 2004). Repetitive practice is crucial for clinical skill acquisition as it makes skill demonstration effortless and automatic (Issenberg & Scalese, 2005). In this study, students in the SPBD group were engaged in repetitive practice after their clinical skills laboratory.

In addition, simulation facilitates contextual, constructive and active learning. The transfer of learning from paper to a realistic clinical situation through simulation enhances contextual learning in PBL. The clinical experiences gained from the simulation allowed students to link these experiences to their discussion of the problem. This enabled students to build more personal interpretations of the problem and thus, enhanced the problem-based discussion (Mamede, Schmidt & Norman, 2006). Also, the simulation, which involves a variety of learning strategies such as role play, videos and discussion, enhances the learning outcomes in PBL by engaging students. Jeffries (2002) stated that using a variety of learning strategies in simulation can accommodate students' diverse learning styles, which is an important pedagogical principle of good teaching. According to Hodgson (1997), learning is deepened when learners are able to perceive the meaning and intrinsic relevance of the subject matter to their own purposes. Immersion into the nursing role through simulation provides students with more valuable insights on the relevance of their clinical skills and knowledge in their field of work.

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Effectiveness of the Classroom Response System in Tutorials

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Introduction

We gathered quantitative feedback via a survey from students taking two physics general education modules (GEM) on their experience using the Classroom Response System (CRS) in their tutorials. The technology incorporates a handheld wireless device (also known as a clicker) that allows students to respond to multiple choice questions posted by the instructor during class. The responses sent by students are captured and analysed once the session ends. This article examines the effectiveness of such a system in the classroom from students' perspectives.

Motivation for Using Clickers

It is common for instructors to be greeted with resounding silence after they have posed a question in class, hence not much can be gathered concerning students' understanding of what is being taught. This may be because students are too shy to speak out in front of their classmates and want to be spared the embarrassment of giving the wrong answer, or they simply may not know the answer.

In the CRS, students respond to the instructors' questions by pressing a particular button on the clicker that represents their choice. The battery-operated clicker is light, handy and durable. The

responses are collected by two wireless infrared receivers mounted on the wall next to the screen. Instructors can time the session according to the level of difficulty of the question posted. At the end of the session, charts displaying the percentages which correspond to the various choices selected will be displayed. Both instructor and students will get to see how everybody responded to the questions.

CRS allows instructors to investigate students' understanding of a topic that is being discussed in the class any time. Instructors could set multiple choice questions for students to answer individually or as a group after discussing amongst themselves. The responses, which will be displayed as a chart of the percentages of various options, give instructors an indication of the extent of students' understanding of the subject matter. A low percentage of correct answers will indicate a low level of understanding of the topic.

The Survey

A survey was carried out over a two-week period to find out how students view the CRS. Two sets of data were collected from students taking two different GEMs. In the first module (Group A), students' participation in class (including answering the clicker questions) was tied to their

tutorial grading. In the second module (Group B), there was no such affiliation. A total of 534 students were polled (Group A: 246, Group B: 288).

The survey required students to answer seven questions with five options: A—Strongly Disagree, B—Disagree, C—Neutral, D—Agree, E—Strongly Agree.

Survey Results: What We Learnt

Figures 1–7 show the responses to the seven questions by both groups of students:

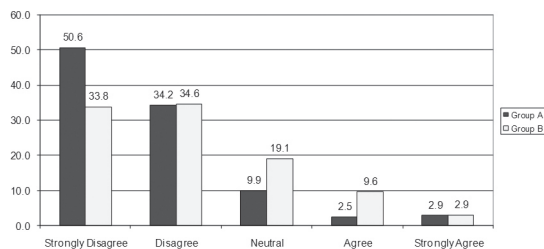


Figure 1. Results for Question 1 (I found the use of clickers distracting and unhelpful.)

91.1% of the class did not feel the clickers were distracting or unhelpful. This indicates an overall positive impression of using the CRS.

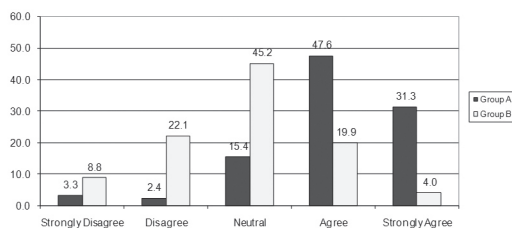


Figure 2. Results for Question 2 (Learning with clickers improves my understanding of the course content.)

78.9% of Group A felt the CRS improved their understanding of the course content, whereas only 23.9% of Group B students felt the same way. This disparity could be due largely to the quality of the clicker questions asked and whether they promote a deeper understanding of the subject matter. This is a strong indication to instructors to be aware that questions should be

properly framed so as not to limit the potential impact CRS could bring to students' learning.

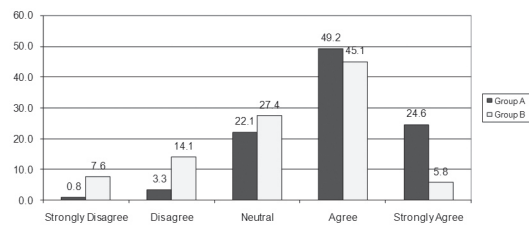


Figure 3. Results for Question 3 (Using clickers promotes more focused discussion during class.)

Like the previous question, more students in Group A felt that the CRS promoted a more focused discussion during class compared to students in Group B (73.8% versus 50.9%). It is possible that students in Group B felt that the clicker questions were just checking their understanding and did not actually promote discussion. Thus instructors should be aware of the need to phrase clicker questions properly so that they lead to more focused class discussions.

80% of students deemed the CRS as being able to motivate their participation in class. This positive experience therefore benefits students by as they move from a passive to active mode of learning.

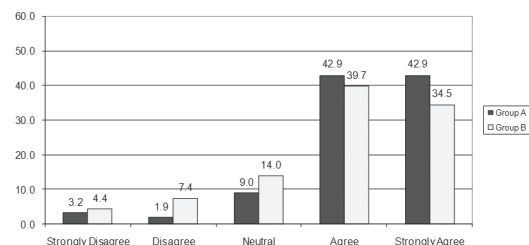


Figure 4. Results for Question 4 (Using clickers motivates my participation in class.)

10.2% of students from Group A found using the CRS too time-consuming compared to 24.5% of Group B. One explanation could be that tutorial grading is not tied to participation for Group B's students, so their involvement does not bring them any immediate benefits. Moreover, a high

percentage (76.1%) of students from Group B did not feel that using clickers improved their understanding of the course content. Hence to them, using the CRS may just mean having to spend more time answering questions.

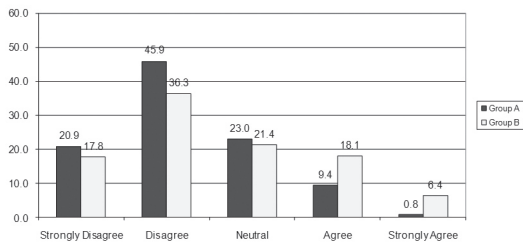


Figure 5. Results for Question 5 (Using clickers in class is too time-consuming.)

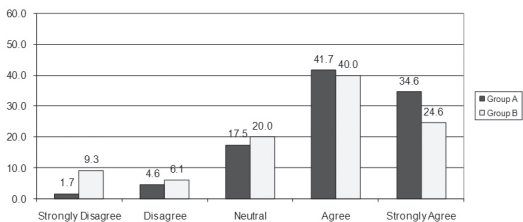


Figure 6. Results for Question 6 (I had difficulties getting my clicker to work in class.)

On the average, about 27.4% of students had difficulty getting their clickers to work. This indicates a necessity to improve on the technology. An additional receiver may need to be installed to collect responses more effectively, especially from students who are not sitting near the existing receivers. Also, instructors should be aware when any clicker fails and replace it with one that works.

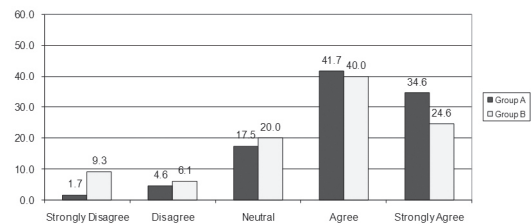


Figure 7. Results for Question 7 (I would like to use clickers in other modules/courses.)

On average, about 70.5% of students liked the idea of using clickers in other courses. The desire to use them in other classes suggests that students have a good perception of the CRS and would like to benefit from its use in other classes.

Conclusion

If the CRS is implemented properly, it could be used to measure what students know before instructions are given (pre-assessment) and test their understanding of what they have learnt (post-assessment). It is also a great tool to facilitate discussion, increase students' retention of what is being taught and help them confront their mistakes. Depending on how instructors design their questions, the CRS allows greater interaction among students, thereby engaging them in the learning process. It is an effective instructional tool and given its potential benefits, support for introducing, training and assisting faculty with this new instructional technology should be encouraged. ■

Real-time Feedback/ Teaching System: Development and Applications*

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Introduction

Timely feedback is crucial in effective teaching. In many instances, student feedback exercises are carried out only at the end of a semester. Till now, an efficient and systematic way of soliciting real-time classroom feedback is possible only in classrooms built with costly state-of-the-art infrastructure and equipment, and is usually limited to small classes. Otherwise, the 'quick show of hands' method has remained the only way to obtain immediate 'yes/no' feedback from a class. There are many scenarios where students' real-time responses need to be analysed and consolidated, especially in large classes. For example:

- Conducting an instant assessment during the lecture/tutorial to assess students' understanding of the material before proceeding to the next part of the course. Currently, this is not possible unless each student is seated next to a computer.
- During an interactive laboratory session or field trip, where an instant assessment of students' understanding is crucial to determine how the teacher should respond.

Our objective is to develop a mobile real-time feedback system which can be utilised by all students without incurring any noticeable costs to students and the school, and without the installation of expensive equipment.

The Technology: Short Messaging System (SMS) on Mobile Phones

We used the Short Messaging System (SMS) on mobile phones as a feedback mechanism. The SMS system is usually based on the Global System for Mobile (GSM) modem or SMS Gateway as shown in Figure 1. We proposed a hybrid configuration and developed a SMS feedback web application based on the GSM modem as shown in Figure 2 (Tay & Tan, 2008). Users are able to create, view and send their feedback via SMS using either the Internet browser or mobile phone. The educator does not need to key in questions or surveys through a computer; he can enter all the information from his mobile device. The user is also able to access the final data through his mobile device. This expands the application of the feedback system as there is no need to access the web portal through a web browser, and student feedback can be easily obtained even during outdoor field trips.

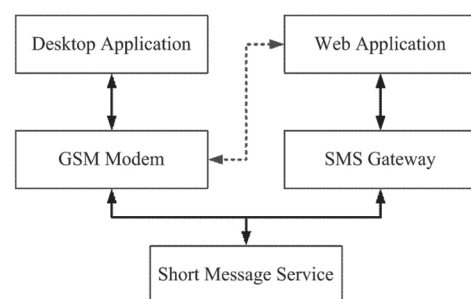


Figure 1. The architecture of the SMS system

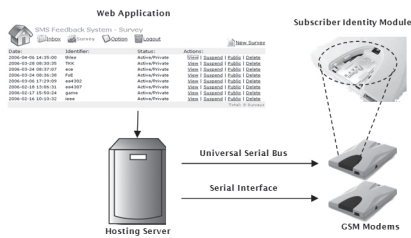


Figure 2. Key components of the SMS feedback system

Applications

The SMS feedback system (<http://www.malresearch.nus.edu.sg:8080/>) was developed and tested in various modules and outreach activities. Once logged on, the user can see the SMS Feedback System Inbox (Figure 3) which contains a list of replies and links to the survey management system and so on.

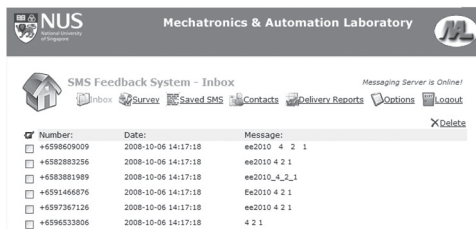


Figure 3. Snapshot of SMS feedback system-Inbox

Sample Quiz in Small Group Teaching

A short quiz (Figure 4) was conducted on 27 August 2008 during a EE2010 “Systems and Control” lecture to test students’ comprehension of the class. Students were required to answer ‘1’ or ‘2’ for all five questions and send their answers in the following format: ‘ee2010 x x x x x’ to 82100082 via the system

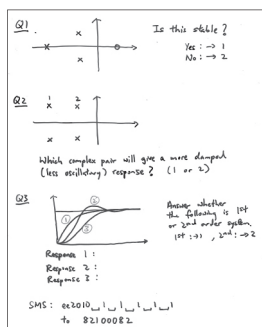


Figure 4. Short-quiz questions from EE2010

37 of 41 (about 80%) students correctly answered the first four questions (see Table 1). However, only 20% of those who responded could answer Q5 correctly as it was based on the extension of a concept learnt during the lectures and details were covered only after the survey.

Student feedback was positive; many said that receiving instant feedback on their learning was useful. Two of the few students who did not respond did not have their mobile phones with them.

The system was also used in EE3302 “Industrial Control Systems” for conducting a survey to check students’ comprehension of various topics for subsequent revision.

Table 1. Survey results

	Q1	Q2	Q3	Q4	Q5
# of ‘1’	30	32	32	3	26
# of ‘2’	6	4	3	32	8
# of errors (not ‘1’ or ‘2’)	1	1	2	2	3
Total #	37	37	37	37	37

Creating the Mobile Survey

Figures 5, 6, and 7 show how the mobile version of the survey is created. The user interface on the mobile phone (Figure 5) displays a list of items available when the application is started. Figure 6 shows the sequence for creating a new survey. Users are also able to view the survey results (Figure 7). Information is usually limited by the screen resolution of the mobile devices. However, with the availability of better and cheaper mobile devices, such applications will become more affordable.

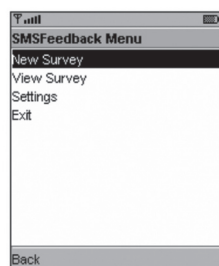


Figure 5. SMS feedback mobile application—main menu

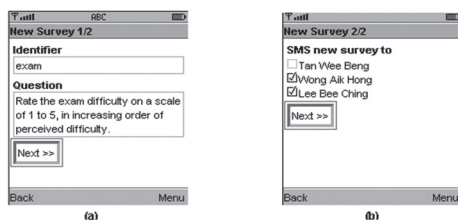


Figure 6. SMS feedback mobile application—creating a new survey

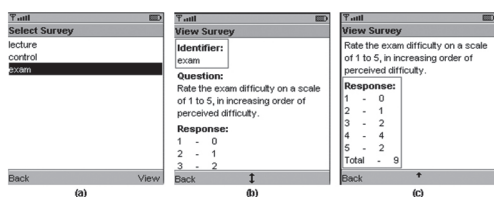


Figure 7. SMS feedback mobile application—viewing survey

Reference

Tay, A. & Tan, K.K. (2008). "Mobile real-time feedback/teaching system". Presentation at International Conference on Teaching and Learning with Technology, 5–6 August 2008, Suntec City, Singapore. ■

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