An Experiment in Improving Engagement with Students in Lectures and Tutorials

Jasmine Banks
Queensland University of Technology, Brisbane, Australia
j.banks@qut.edu.au

***Abstract**: The aim of this study was to experiment with activities that can be done during lectures and tutorials to improve engagement with students. The various activities took place during lectures and tutorials of ENB240 – Introduction to Electronics, a second year Electrical Engineering subject. In the first stage of the project, students were asked what could be done to both improve engagement in lectures and tutorials and to assist with their learning. Based on student responses, various activities were undertaken during the semester including: online quizzes; worked examples on the document camera; using an audience response system with keypads; and passing around physical devices in class. At the end of the semester, "Worked examples on the document camera" was reported by the most students as assisting with their learning, while "Use of keypads" was reported by the most as improving engagement in the lecture.*

Introduction

The aim of this study was to experiment with activities to improve students' engagement during classes. The activities took place during lectures and tutorials of ENB240 – Introduction to Electronics, during early 2008. This is a second year subject which is part of the Bachelor of Engineering (Electrical) course at Queensland University of Technology (QUT). There were 141 students enrolled. Being still relatively new to lecturing, I am seeking ways in which my teaching can be improved.

A teaching method used in the classroom that engages students in the learning process is known as *Active learning* (Prince, 2004). Chickering (1987) lists active learning as one of the seven principles of good practice. The motivation for promoting active learning is that it is claimed that it results in greater learning achievements in students (Nirmalakhandan, 2007). It has been stated that students tend to remember more content if brief activities are introduced into the lecture. (Prince, 2004). This intuitively makes sense – if students are participating in a lecture, rather than passively sitting back and listening, this will at the very least help them to stay awake. If they are engaged in answering questions or solving problems, then this could help them to remember what was covered in the lecture, and in understanding the subject material.

In (Cowan, 1998), teaching is defined as "the purposeful creation of situations from which motivated learners should not be able to escape without learning or developing". Through "active learning", that is, students participating in class, and through making lectures more interesting, I hope to create situations that motivate interest in a topic and assist their learning as much as possible.

Phase 1 – What do students want to see in lectures and tutorials?

The first stage involved gleaning ideas from the students themselves about what could be done in lectures and tutorials to first make them more engaging and second to help students in their learning. A questionnaire was handed out during class early in the semester, and was also made available online for students who were absent on the day. An email was also broadcast to all students in the unit requesting their help with completing the questionnaire.

Twenty responses were received. The questions that were asked and a summary of the responses received are as follows:

1. "Is there something that could be done in lectures or tutorials that would help you learn?"

The categories of responses received and the number of students who gave each response are listed in Table 1:

Response	#Respondents
Provide practical examples	2
Worked examples written by lecturer's hand	2
Worked answers to tutorials	1
More time to absorb information	2
Discussion, interaction	2
Quizzes throughout the semester	1
Diagrams, videos	1
Lecture notes with spaces for students to annotate	1
Group work in tutorials	1

Table 1: Responses to the question "Is there something that could be done in lectures or tutorials that would help you learn?"

2. "What could be done so that lecturers better engage with the class during lectures and tutorials?"

The categories of responses received and the number of students who gave each response are listed in Table 2:

Response	#Respondents
Provide practical examples	2
Humour, sudden noises	3
Write on the document camera or on the board	2
Active demonstrations	1
Include students in working out problems	2
Video and sound	2
Ask students to explain to the class	1
Smaller groups	1

Table 2: Responses to the question "What could be done so that lecturers better engage with the class during lectures and tutorials?"

Phase 2 – Implementation of ideas

It was decided to pursue the following activities which were achievable in the time and resources available:

1. Convert tutorials into Online quizzes

This addresses the requests for "worked answers to tutorials" and "quizzes throughout the semester". For two weeks, the same problems that had been traditionally given in the form of a paper tutorial were presented in the form of an interactive online quiz. The quizzes were prepared using the Blackboard software, which is used at QUT to provide learning resources online. The tutorial for those weeks was held in a computer room instead of the usual classroom. This style of tutorial enabled me to walk around the room and talk to students individually about problem areas. The quizzes provide built-in feedback, that is, if an incorrect answer is entered a hint is given on how to do the problem. Students could also work on the quizzes at home for revision.

2. Work through examples on the document camera

The document camera is a device available in lecture theatres that allows paper documents to be projected up onto the display. Therefore lecturers can work though an example on paper and it is

displayed on the screen for all students to see. During two lectures, I worked through problems on the document camera, addressing the requests for "More examples written by lecturer's hand" and for lecturers to "Write on the document camera or on the board". The problems involved drawing diagrams of transistor amplifier circuits and calculating various currents and voltages in the circuits. Students were able to ask questions while the problems were being worked out and I also asked the class for input. Later, the written notes were scanned and placed online for anyone who may have been absent.

3. Use the Audience Response System Key Pads

This provides a way of doing more examples in class and addresses the request to "include students in working out problems". The "Keepad Interactive" system and "Turning Point" software (Keepad Interactive, 2008) available from Audio Visual Services at QUT were used in two of my lectures. The keypads are shown in Figure 1. During the lecture problems were presented with several answer options. Students calculated their answers and pressed the button on the keypad corresponding to their answer. After enough people had answered the polling process was closed and the number of responses for each answer were displayed. Usually most students chose the correct answer. After the answer was displayed I explained why some of the alternatives were incorrect. The keypads allow all students to attempt a problem and choose an answer anonymously, without having to speak in front of everyone.

Figure 1: Keypads and the Universal Serial Bus dongle for the "KeePad Interactive" system.

4. Passing around physical devices in class

This activity partially addresses the request to "provide practical examples". An assortment of the devices being studied in this subject (diodes and transistors), were soldered onto boards. Devices with different properties and packaging were chosen. The properties of the devices and differences between them were discussed, and data sheets were shown, illustrating some of the device properties that we had covered in class. Figure 2 shows two of the boards that were passed around in class.

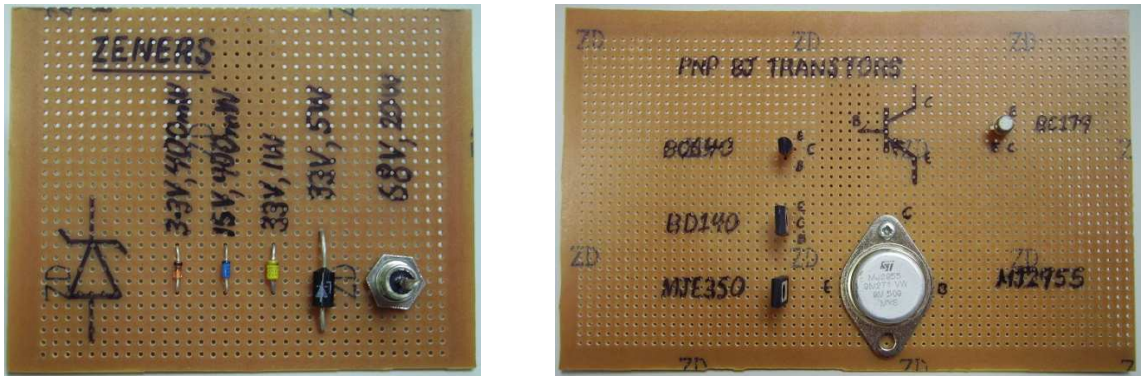

Figure 2: Two examples of boards constructed for this project, showing examples of the actual devices being studied: (left) Zener diodes (right) transistors.

Phase 3 – Feedback

A questionnaire requesting feedback on the activities undertaken in Phase 2 was released later in the semester. Twenty-one responses were received. The following questions were asked (where (a),(b),(c),(d) in the questions refer to the activities described in Phase 2, listed in Table 3):

1. Which of (a),(b),(c),(d) helped with your learning in ENB240 and why?

For each activity the respondents who reported that the activity assisted their learning are listed in Table 3:

Activity	#Respondents
(a) Online quizzes	12
(b) Worked examples on the document camera	16
(c) Use of Key pads	7
(d) Passing around physical devices in class	2

Table 3: Number of respondents who reported that a particular activity assisted their learning.

Some comments explaining why these activities helped with learning were:

"I feel that (b) and (c) helped me learn because it made me actually follow what you were writing down."

"(c) The use of the key pad. It was an interactive way of doing worked examples yourself. Then you got to vote!"

"(d) put the actual thing we are learning about to a real example"

"(a) This allowed me to experience an exam type setting"

"(c) Keypads were a good interactive learning tool. Doing the question in the lecture and submitting answer anonymously is good"

2. Which of (a),(b),(c),(d) helped improve engagement in lectures and tutorials and why?

For each activity the respondents who reported that the activity improved engagement in lectures and tutorials are listed in Table 4:

Activity	#Respondents
(a) Online quizzes	3
(b)Worked examples on the document camera	8
(c) Use of Key pads	14
(d) Passing around physical devices in class	5

Table 4: Number of respondents who reported that a particular activity assisted engagement in lectures and tutorials.

Some comments explaining why these activities improved engagement were:

"The novelty and 'fun' use of them [the keypads] helped everyone improve and concentrate more on your lectures"

"(b) was helpful to improve engagement, it got us doing work and learning in the lectures"

"(c) keypads were entertaining people during the lecture! It was a great learning tool"

"(a) helped me to understand how to find answers for the problems"

"(d) seeing how the devices looked in the real world, not just as symbols on a circuit diagram, made lectures more interesting."

3. Any further comments/ideas?

A number of respondents (7) mentioned that they would like more example problems:

"Do more (b) because they are helpful, and give people time to ask questions and write down notes."

"More examples, even though there was plenty, they never hurt."
"More worked examples, similar to what can be expected in the exam"
"Go through more problems in lectures is the best way to learn."

Reflection and Discussion

Online quizzes

The first online quiz seemed to be received positively by the class. During the tutorial I was able to individually help students. In addition students were talking among themselves and helping each other. I was also encouraged by informal feedback about this activity. A student I met in the corridor afterward said that he liked the online tutorial, since it allowed him to practice the problem over and over and "build up confidence".

For the second online quiz the reaction was less encouraging. Only about half the usual number of people attended. Also an assignment for the subject was due, and a number of students were sitting at the computers working on the assignment instead of the quiz. Perhaps some students may have stayed away because they were working on their assignments. Despite this, a number of students who did attend said that they enjoyed the online quiz.

The quizzes were reported by 12 respondents as being helpful for learning, but only 3 respondents reported them as improving engagement. Some positive comments, in addition to those mentioned previously, were:

"(a) Blackboard Quiz's are a great way to provide feedback to the student so he is aware of how he/she is progressing with the subject material."
"I found (a) and (b) helpful for my study and understanding"

One student reported the quiz as not improving engagement in that it "drew me away from asking questions in tutorials". Perhaps that student found it easier to ask questions if the problem was done on the board in front of the class. Another problem with using the quiz in class was that it slowed down the tutorial, in that students worked through a smaller number of problems on their own, than what I would normally work through on the board.

The low number reporting the quiz as helping engagement could be due to the quiz only having been used in my tutorial group, therefore only a few students had experienced the quiz in a classroom setting. Although the quiz had been made available to all students in the unit, perhaps many students had not yet used it by the time that the second questionnaire was released.

Worked Examples on the Document Camera

Working out examples on the document camera was consistently well received, 16 students reporting it as assisting their learning, and 8 reporting it as improving engagement in lectures. It would be useful if all lecture theatres had two displays, allowing a relevant part of the presentation and the working on the document camera to be displayed at the same time.

Use of the Audience Response System Key Pads

The use of the keypads was reported by 14 respondents as improving engagement in lectures and 7 respondents said that the keypads helped their learning. In addition to the comments mentioned previously, a number of people reported positively on this activity:

"The use of the keypads stimulated the mind because of its novelty, which everyone, I thought, appreciated it."
"Definitely the use of the keypads helped improve engagement in the lectures. The novelty and 'fun' use of them helped everyone improve and concentrate more on your lectures"

Some people felt that they slowed the lecture down:

"The keypads were a little overused and it made your lectures a bit slower. I still very much liked the use of them though"

I agree with this. If I use the keypads in the future perhaps I could reduce the number of slides that have keypad input. Two respondents did not like the keypads at all:

"I found the use of the keypads was pointless. It pretty much was the same as doing examples but wasted a lot of time setting up and waiting for people to answer."
"The keypads were bad, only distracted people"

Audio Visual Services at QUT warned me that typically a number of keypads go missing in every class. I was pleased to report that out of the 100 keypads I had borrowed, none went missing during the first week and only one went missing during the second week.

Passing Around Physical Devices in Class

Passing around the physical devices in class was reported by 2 students as assisting their learning and 5 students reported it as improving engagement in lectures. This activity was more positively received than I anticipated. In my undergraduate study I frequently had hands-on exposure to diodes and transistors. However in ENB240 practicals the diodes and transistors are hidden away in a box, so it is possible that some students have never actually seen one. Some positive comments were:

"(d) Good to see what transistors look like in real life"
"(d) Always a grt8 idea for show and tell, passing around objects that students can feel with their own hands"

The last respondent went on to say that if people saw how small diodes and transistors are in real life they might think: "I can't let something so small beat me, I am sure I can grasp what is happening inside one of those!", and that this may motivate students. However, it was also reported that this activity could be distracting in class:

"(d) was interesting…but also have the potential to distract you from the lecture"

Conclusions and Further Work

The four activities attempted during the semester all received more positive comments than negative. "Worked examples on the document camera" was reported by the most respondents as assisting with their learning, while "Use of keypads" was reported by the most as improving engagement in the lecture. The keypads did slow the lecture down since I had to wait for a sufficient number of people to answer. However I still think they were worthwhile, and introduced a novelty and fun aspect to the lecture. In future I would still use them but reduce the number of slides on which they were used.

In the second questionnaire many students mentioned they would like more example problems. This is one area I would like to address in the future. In addition the online quizzes could be extended to cover more of the subject content. Even if tutorial classes were done in the traditional manner in a classroom, students would be able to use the online quizzes to complement what was covered in tutorials and practice problems over and over again.

One of the suggestions from the first Questionnaire was to "provide practical examples" and "active demonstrations". I would like to do more in this area in the future. For example a working transistor amplifier circuit could be built and passed around in class, and in addition the circuit diagram displayed in class and explained. Also some real life examples showing where the circuits studied in class are used could be shown.

References

Chickering, A. and Gamson, Z. (1987) *Seven Principles for Good Practice*, AAHE Bulletin, 39, ED283491, 3-7.

Cowan, J. (1998) *On Becoming an Innovative University Teacher - Reflection in Action*, The Society for Research into Higher Education and Open University Press, p. 47.

KeePad Interactive (2008), Accessed at http://www.keepad.com/home.php on 28 May 2008.

Nirmalakhandan, N., Ricketts, C., McShannon, J. and Barret, S. (2007) Teaching Tools to Promote Active Learning: Case Study. *Journal of Professional Issues in Engineering Education and Practice*, 133(1), 31-37.

Prince, M. (2004) Does Active Learning Work? A Review of the Research, *Journal of Engineering Education*, 93(3), 223-231.