

EFFECTIVE ACTIVE LEARNING STRATEGIES I HAVE USED IN UNIVERSITY CLASS ROOM

S. Talele

University of Waikato (NEW ZEALAND)
sadhana@waikato.ac.nz

Abstract

In this paper I summarize the various activities used in class room and laboratory teaching of first and second year engineering. These activities can be grouped under 'active learning'. I describe the activities and the various attributes associated with each activity along with the advantages of using the mentioned activity model instead of simply a single ended lecturing model. Although most of these have erupted from an urge to increase students learning while making the topics increasingly interesting for them, most of these strategies have been researched out globally as effective teaching practices.

Traditionally lecturers may think that they are doing active learning when questions are asked and a few students always answer or discussions amongst the same group of people take place from time to time. Although this includes student participation, it is engaging only a small fraction of a big class which is not optimum in terms of benefit to the class as whole and individuals of the class. Active learning is taking place in your class when you ask a question, pose a problem, or throw some type of challenge at them; ask your students to work individually or in pairs or small groups to come up with a response; give them some set time to do it; stop them, and invite one or more individuals or groups to share their responses with the class. The teacher as an expert can further comment on the answer if required.

This paper concludes with a number of proven methods of including active learning strategies in first and second year Physics/electronics engineering class. Reference to global research about these strategies is included.

Keywords: Active learning.

1 INTRODUCTION

Active learning is generally defined as any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think about what they are doing [1]. In practice active learning refers to activities that are introduced into the classroom the main elements of active learning being student activity and engagement in the learning process. Active learning is often contrasted to the traditional lecture of the one way traffic model for teaching.

Active learning can be divided in sub-types as follows:

Collaborative learning can refer to any teaching methodology in which students work together in small groups toward a common goal [2]. This means all group-based instructional methods can be included in collaborative learning. The important criteria for collaborative learning is the emphasis on student interactions rather than on learning as an individual activity.

Cooperative learning can be defined as a structured form of group work where students pursue common goals while being assessed individually [3, 4]. The important criteria for Cooperative learning is the focus on cooperative incentives rather than competition to facilitate learning.

Problem-based learning is an instructional method where relevant problems are introduced at the beginning of the study topic cycle and used to provide the context and relevance for the learning that follows[prince]. This process is always active and not necessarily collaborative or cooperative. *Problem-based learning* can generally involve good amounts of self directed learning[1]

2 BACKGROUND

Reasons for under achievement: Imagine you have a Monday morning lecture and 20 minutes into the lecture students still do not show active participation in the lecture, they are sleepy, tired and busy communicating on their cellphones or laptops either by texting or emailing (thanks to the wireless technology available in all the classrooms nowadays). Even these days, this can be the scenario in many class rooms with teacher centred teaching-plane simple one way traffic of speech and an attempt to get through a lot of material.

I have been in teaching for more than two decades and I do not believe in the one way traffic model for teaching. The above mentioned methods of active learning are useful. Experience suggests that the unsatisfactory academic achievement in university first/second year can be attributed to reasons like

- (a) Weakness in background knowledge
- (b) Insufficient mathematical ability
- (c) Not able to extract data from the language of the problem (language ability)
- (d) Teaching pace is too fast
- (e) In the class not due to own interest but being pushed by parents.
- (f) Not engaging themselves in laboratories, expecting the demonstrators to solve their problems and they just take readings.
- (g) A learning approach where students crammed for examinations without searching for the understanding the concept behind.
- (h) Insufficient study hours
- (i) Inappropriate study strategies
- (j) Too many distractions
- (k) Not keen on putting much work in the course if the course is open book end of semester exam

3 METHODS

This paper details about the existing situations and the way of including active learning used for all of the above attributes.

- (a) Generally these introductory courses are pre requisite courses for engineering students. The students are in the course after having got through the screening of whatever level the university has in place. The high school Physics calibre is measured in term of NCEA credits earned by the student in the pre university study year. It appears that the modular system of earning these credits means that some students have not done a particular topic at all and thus is very weak in the background knowledge in that particular topic. If this is the topic most necessary for the first year course then there is a problem. One such example is the topic on electricity. This situation leaves the students in a class with a huge range of ability.

Collaborative learning is useful here. The best way to overcome this is to have good set of study notes in a form of a mini booklet with a lot of practice problems as homework. I go over these problems in a very rapid manner in a tutorial class as a group activity. For very simple problems a group of two students can explain to the group their method of solution and if correct I agree and we move to the next one.

- (b) Carrying on from the issue in the above point, it is seen that the mathematical ability of students is limited and this works like a brake in their progress in engineering situations. Here I am hinting at a very low level but useful algebraic ability of rearranging, cross multiplying and so on. The only way which works like a magic for these individuals is to take them through the simple algebra once again at this stage. This has been especially a problem with medicine/Biology students doing first year Physics.
- (c) With the growing number of students moving around in the world for specific education or in a specific country, recently we find a lot of international students from Middle East/ South East Asian countries. These students English ability is limited. My experience is that they can communicate well and can read the text well but do not get the data from the information as expected. They need to be taught to read for the meaning and information. I make them a habit

of writing the data as they read and it seems to improve their skill. Also sometimes a second reading confirms the data they wrote in the first go. This problem gets extended to the student's unwillingness to read text books as they find it too hard to get information out of them. The use of text books has been decreasing over years and students are more and more reluctant to do any text book reading. These days students refer to internet for their studying and the rest is based on teacher's notes. I fail to say that any particular strategy has worked in getting the students to read more of text books. Only an open book exam seems to encourage them to own a book and then they put high lighters or tags but not read through the text as in olden days.

- (d) During the many years of teaching I have experienced that if we take the students with us in the initial lectures by going at a comfortable pace then the students are more ready in the later period to pick up the pace. I like to throw questions to the class and sometimes individuals can answer or a number of times the whole class can answer if the answer is in terms of yes/no, negative/positive or up/down etc. Sometimes I divide the class in natural small parts like each row or two rows or so get them to answer such questions. It does get their sense of participation going and keeps them away from boredom due to being quiet receptors [active]. Sometimes I ask them to discuss with the person sitting next to them and then get them to put up their hands up for a particular answer and count hands in a row and write on board the voting pattern. This I class as cooperative and collaborative learning. Experience suggests that this strategy works very well for first years with a big class.
- (e) Over the number of years it has been observed that the students born and brought up in Western countries generally choose their own line of interest for higher studies. However a lot of students from eastern countries seem to be not having that choice. This makes it uninteresting for these students and the natural capability of a person in a particular area does not get used. I only came to engineering because my mum said to is not very uncommon in these student populations.
- (f) Following on from the previous point it so happens that since these students are in the class not by their own choice and this makes them inactive in the class due to lack of motivation. These are the students whose thinking goes like "I have paid the fees; the demonstrator should do the connections I will just note down the readings. Their realization of the fact that it is by doing that he learns and not by seeing alone. This idea needs to be imbibed on them and examples shown/proven as far as possible. This scenario needs an ice breaking strategy to get them motivated. Collaborative learning strategy is helpful. This is easily done by getting pairs to do experiments together.
- (g) A learning approach where students crammed for examinations without searching for the understanding the concept behind: We have all experienced as teachers about our students telling us that they are going to work all night before appearing for the final exam the next day. This method of learning gets them through the examination with average marks but the knowledge does not last for long enough. This is because they have not had the time to digest the concept and make it a part of themselves. Subsequently it is not a surprise that in the third year their teacher finds that the students do not know well enough some basic first and second year material. The solution to this problem is to have mid-term assignments and tests which contribute some credit to their final grade. In courses where laboratories play an important part, getting them to contribute in doing laboratory sessions themselves in the presence of the teacher is an excellent idea. Generally a healthy discussion on the concepts can take place and can link the concepts from theory to practice very well. In laboratory sessions the peer help is also an important factor that can be well used. This cooperative learning is very helpful. Possibly this effectiveness of this approach has to do with student attention span during lecture [5].
- (h) Insufficient study hours: Recent student culture sees students involved in a number of activities and this does not give them a chance to have sufficient study hours. Television, video games are the biggest to be blamed [6]. Even the study hours that they do have are contaminated with disturbances like email, face book and texts to name the least.
- (i) Inappropriate study strategies: In course like analogue electronics where a lot of new concepts are built on top of the earlier one. This means a lot of topics are linked to the previous one and if students ignore the initial chapters due to lack of good time management and so on then they start finding the subsequent topics much harder than expected and as a result start losing interest in the subject. Upon talking to them about this issue they say they plan to catch up in a week or so but they have already started falling behind by then and it becomes all the more

difficult. I have found that on-going assignment questions can be helpful in giving a good self-judgement to the students about their abilities from time to time. If they ignore these assignments then sometimes a catch up lecture after a huge topic where mind map of the topic is done in the class with the input from the class members can be helpful.

- (j) Too many distractions: I am sure all teachers over the age over 50 years would agree with me when I say that in those days when we were graduating we had little or no distractions. This definitely helped us concentrate entirely on whatever we were doing and this definitely helped. It is becoming more and more difficult to control students checking their phones in class because the argument is that "I am referring to the online notes".
- (k) Not keen on putting much work in the course if the course is open book end of semester exam:
I teach a second year course in electronics and traditionally we have been interested in them understanding the underlying concepts rather than memorise. Thus the final examination is an open book one. Students think for a long time that open book exam means they do not need to study too much just put highlighters or tags and it is all done. The reality is that they could spend turning pages of the book for a long time and still not get the answer to the question because the question is based on applying the concept rather than just the knowledge itself which is written in the book. I run a mock test in the mid-year and make this also a open book. This does give them an experience of the open book examination and the nature of questions that appear in it.

4 CONCLUSION

A summary of existing problems in tertiary teaching and the strategies used to overcome these is given her.

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