Effective Teaching in a Large Tutorial Class

Ng Geok See, Schubert Foo
Division of Software Systems, School of Applied Science, Nanyang Technological University

Abstract

The aim of this paper is to investigate the problems of conducting mathematical oriented course in a large tutorial class setup with a typical student-staff ratio exceeding 60:1. The study is based on the computer engineering students from the School of Applied Science, Nanyang Technological University, Singapore. A survey and interview methodology was used to confirm if students are experiencing difficulties in adjusting to a large tutorial class and to identify students' perception of an effective tutor. Subsequently, a set of guidelines is proposed to enhance the learning process in the tutorial class. The guidelines include the encouragement of active participation, giving clear objectives and expectations and the establishment of psychological contract right from the beginning of the course, keeping and sustaining the students' interest through the use of improved teaching aids and innovative techniques.

1 Introduction

The Nanyang Technological University (NTU) of Singapore admits about three hundred students annually for its computer engineering undergraduate programme. This is a three-year degree programme conducted in the School of Applied Science with an optional fourth year for a Honours programme. The university adopts the Academic Unit System in the conduct of its courses. Under this system, an academic year is divided into two semesters of sixteen weeks and each subject is assigned a certain number of academic units. The subjects of study are classified under three categories, namely, core subjects, prescribed electives and free electives. Core subjects are compulsory subjects required to satisfy course requirements. Prescribed electives are subjects for specialisation in a particular degree courses while free electives are subjects chosen by students to broaden their learning experience or have more in-depth study in any particular field.

The prescribed electives offered by the School are all basically mathematically-oriented courses specialising in a particular aspect of computing technology. Examples of prescribed electives offered in the School include Application-Specific Microprocessors, Artificial Intelligence, Advanced Computer Graphics, Compiler Design, Digital Signal Processing, Computer Vision & Image Processing, Robotics, and so on. These courses
are conducted through a total of 26 lecture hours, 13 tutorial hours and 30 hours of laboratory work. In the current arrangement, one lecturer is assigned to handle one prescribed elective fully by himself or herself. Typical class sizes vary from as low as 10 students to a high of 120 students. This translates into a small to a large class environment. In such instances, different teaching methods are needed to ensure high quality student learning.

There is a lot of evidence describing which teaching methods lead to high quality student learning. Most of the researchers examining the relationships between teaching methods and learning have been based on the criterion of "achievement" or "academic performance" (Entwistle, 1992). The precise definition of what counts as "achievement" varies from university to university, from discipline to discipline, and even from department to department (Entwistle et al., 1992). Lecturers in higher education have a good deal of freedom in deciding how they teach. They have much more control over their styles of presentation. Elton (1987) indicated the need for training of academic staff to help them adapt and change their teaching styles.

This paper aims to investigate the problems of conducting mathematically-oriented courses in a large tutorial class setup with a student-staff ratio typically exceeding 60:1 and to derive a set of guidelines to enhance the students' learning effectiveness. A survey and interview methodology was employed to identify common problems encountered by students, to find out about their perceptions of a good tutor, and to obtain suggestions as to how such classes can be improved. Based on these findings and related literature, a set of guidelines is formulated and proposed in this paper.

2 Problems Encountered in Current Practice and Survey Findings

The student population in the School is dominated by male local students who have undergone two-and-a-half years of National Service in the Armed Forces. As confirmed during the interview, many students have forgotten over this period of time of what was been taught in their pre-university or polytechnic education. This have led to initial teething-in problems at the earlier stages of the course but as prescribed electives are taken later during the course, most students have already settled down and adopted particular study habits and processes. Nonetheless, they are experiencing large tutorial classes for the first time since the lecture class size is the tutorial class size itself. This is contrary to core subjects and free electives which are divided into smaller groups of between 25 and 30 students for tutorials.

In carrying out this study, a sample of a typical prescribed elective class (in this case, Computer Vision & Image Processing) of 60 students was chosen to answer a 20-question survey at the end of the semester after the tutorials have been completed. It is the intention of the survey to confirm if students are experiencing difficulties in adjusting to a large tutorial class using the present mode of conduct. In addition, students were also asked to identify common problems, their preference on how such tutorial classes should be conducted and their perception of a good tutor. Finally, an informal interview was
conducted with a random selection of 5 students to confirm the findings and to solicit other pertinent information which might not be readily conveyed in the survey.

It was found that due to the large class size in tutorials, students have relied more on the existence of tutorial solutions. As the chances for active participation is less when compared with smaller classes, the tutor also tends to present all the tutorial solutions to the class most of the time. In other words, the tutor tends to conduct tutorials by using the "executive" teaching method. Tutorials often translates into a 'mini-lecture'. The problem of using this teaching method is that it degenerates down into a one-way communication between the tutor and the students (Weinstein, 1988); an observation noted by the students. This becomes a major drawback of teaching a large tutorial class as it causes the students to become more passive learners. The shyer students, who might have the confidence to contribute in small groups, tend to keep quiet in large ones.

Another interesting factor is that due to logistic arrangements, the tutorial classroom is also the same lecture theatre used for the conduct of lectures. This has somehow caused the passive behaviour of students in the lectures to permeate into the tutorials.

Developing rapport between students and tutor is more difficult in a large tutorial class. As one of the teaching staff noted in the survey conducted by Gibbs and Jenkins (1992), it becomes progressively more "difficult to know individual student. This reinforces my (the teaching staff) feeling of performing rather than teaching. I am certain the students want to be known as individuals". This is the same feeling experienced by the authors in conducting such large classes.

Students tend to lose attention in the tutorial class because of the inability to participate. Participation can also be lost because the course material is seen to be boring with much mathematical formulae. As the students' background and intellectual ability is diverse and different, poorer students felt that the tutorial pace was too fast. In contrast, the better students felt that the pace was too slow. It becomes necessary for the tutor to find an optimum pace and the correct level of explanation needed to suit the majority.

In one survey question, students were asked to identify which of the following four methods was most beneficial and efficient in helping their learning:

(a) Tutor provides ALL model answers.

(b) Student presents solutions individually and the class/tutor will question him/her on the solutions.

(c) Student present solutions as a group and the class/tutor will question them on their solutions.

(d) Tutor present the solutions and the students will, under the guidance of the tutor, explain the given solutions.
The motive of the question as to ascertain whether the students adopts a preference for active or passive learning. As seen from Figure 1, it clearly indicates that 55% of students prefer the tutor to provide and explain model solutions: a confirmation that the majority tend to be passive learners. However, 23% of the students indicate that they like to explain the solutions but with the guidance of the tutor. This indicates that given an opportunity, a significant number of students would like to participate actively in the tutorial class.

In another question, students were asked to select from a list of criteria, the most important five factors which makes an effective tutor:

(a) Facilitate student interactions.
(b) Speak clearly and effectively.
(c) Humorous, kind and approachable.
(d) Handsome/Pretty and well dressed.
(e) Sensitive and sympathetic to student's workload.
(f) Illustrate theory with appropriate examples.
(g) Distinguish records in publishing research papers.
(h) Emphasize on important topics for examination study.
(i) Allow students to obtain a copy of tutorial solutions.
(j) Do not expect students to prepare for their tutorial.
(k) Confident and responsible.
(l) Show enthusiasm in the subject.
(m) Able to stimulate student's interest in subject.
(n) Present tutorial in a well organized manner.
(o) Availability to answer student queries and friendly to students.
(p) Provide opportunity for self-paced learning and interactive group work through planned modules and support resources.
The results indicate that almost all students thought that presenting the tutorial in a well-organised manner is the most important criterion, followed by the tutor's ability to stimulate student's interest in the subject. Interestingly, very few (11.67%) favoured the opportunity for self-paced learning and interactive group work through planned modules and support resources. This in turn shows that students to a large extent are dependent upon the tutor in tackling tutorial questions.

These results are not encouraging as they point to the tendency of passive learning and dependency on solutions and tutors for guidance. However, as this sample is only a subset of the total population of students, more samples and the application of statistical inference is necessary to confirm these general observations. Nonetheless, with the last chance of full-time training in the university before joining the workforce, it is highly desirable for students to transform themselves from such behaviour to become more independent and adopt the meaningful and deep-achieving approach in their learning. This can be attained through a systematic framework to help students at the individual, small group and class level make the transformation in order to benefit from the university's education system (Foo and Ng, 1996).

3 Proposed Changes to Conducting Large Tutorial Classes

3.1 Encourage Active Participation

Attempts should be made to encourage active participation in the class regardless of class size. One possibility is to divide the big tutorial class into subgroups and allocate different questions to each subgroup. After a short time for group discussion, a group member is randomly picked to present the solution with the remaining group members in assistance. During the presentation, other students may ask for further clarifications or criticise the solution. The performance of the selected student is noted. Likewise, participating group members and other students will also be noted. This is basically the
force participation approach (Ball and Ng, 1995). This form of technique is particularly useful for Asian students whose education culture in pre-university is still largely spoon-feeding. In addition, Asian students are brought up in families which advocates submissive behaviour to their parents and seniors teachers. Such behaviour is brought from home to school which is a contributory factor for their passive nature.

Tutorial questions have to be revised so that there should at least a proportion of questions which are more open-ended with more possible solutions, yet keeping within the main objectives of the tutorial topic. Such open-ended questions will stimulate student's thinking about the topic and allow more lively interaction to take place. For example, a question like "What do you think of future home automation if the human vision is replaced by the computer vision?" will provoke the thinking process more than a straightforward question like "What are the applications of computer vision in home automation?".

3.2 Give Clear Objectives to the Students

Specifying the objectives of the course on the first day will help students to stay better focussed throughout the course. A general description of what the students will be able to do at the completion of the course is essential. Main objectives must not be confused with complementary, subsidiary or intermediate objectives so that students are clearly aware of course requirements and expectations. A main objective might read as "the ability to use certain mathematical principles to solve certain type of image processing problem" while mastering such mathematical principles will become component or subsidiary objectives.

3.3 Establish Psychological Contract Right from Beginning

Another teaching strategy that we would like to implement is to establish a psychological contract with the students right from the first tutorial class. On the first day of tutorial class, it is important to share the tutor's expectations of the tutorials with the students. It is essential to inform students that the tutorial will be participatory in nature and that they will be assessed from their participation. After which, students are invited to give their expectations of the tutor in the conduct of such participative tutorials. Such feedback will allow the tutor to fine-tune the method and level of active participation. It takes two hands to clap! In so doing, the tutor will know the psychological need of the students. By "signing" the psychological contract between the tutor and students, it often draws high performance of the students in the tutorial class.

3.4 Keep and Sustain Students' Attention

It is difficult for students to carry out a passive task for very long without losing attention. Several learning situations suffer from this problem, including those of listening to tutor and passively reading a text book. It is a classical observation that learners lose attention in lectures quickly. Fifteen minutes into a lecture, students will be performing much less than at the start (see Figure 3)(Gibbs and Habeshaw, 1989). Their
physiological level of arousal will be lower. They will be recording fewer notes, and these notes will be less accurate and will contain a smaller percentage of key ideas. At such, it becomes important to break up the 15-minute attention spell with some planned activities.

Figure 3. Students' Attention over 60 Minutes of Tutorial

Attention is an element of motivation. It is also a pre-requisite for learning. This implies that students have to be motivated in order to be interested in the course. Although prescribed electives are mathematically-oriented in nature, it is still possible to stimulate and maintain students' interest by continually and consistently giving good examples on the applications of the course. We have found out that some of the course material can be better represented and conveyed using pictures or real images. Thus, when appropriate, the cliche 'a picture tells a thousand words' can be put to good use to eliminate a considerable amount of material from the course.

3.5 Improve the Use of Teaching Aids

However, getting attention is not enough. A challenge is to sustain it and to produce a satisfactory level of attention throughout a period of instruction. Filep (1973) noted that an average university student spends an extra 40% of their time viewing television than they did in secondary schools. This provides an indication that students' attention can perhaps be better captured if graphics or visual effects are used in teaching. We have the intention to employ an additional teaching aid: the portable Personal Computer (PC) into the tutorial class to show the visual effects of the mathematical computations of images. In doing so, students can visualise immediately the results of image processing and better appreciate the essence of the processing algorithms. Such demonstration will no doubt improve students' attention in the tutorial as they become more actively engaged in learning and be able to relate theory to practice through direct observation.
3.6 Create an Environment Conducive to Learning

Finally, it is important to create an environment conducive to learning. Lectures and tutorials form a different medium for teaching and learning. This being the case, it is important to conduct lectures in a lecture theatre and tutorials in a tutorial room with the appropriate teaching aids. Furniture in lecture theatres are generally fixed and immobile while that in tutorial rooms generally offers scope for re-arrangements and changes. Details such as furniture arrangement, lighting conditions, position of the tutor and so on all contribute to making the correct ambience for effective teaching.

4 Conclusions

The survey and interview methodology used in this study, although simplistic, has nonetheless managed to provide information to indicate the students' passive preference in a large tutorial class and their reliance on the provision of tutorial solutions. If it is the aim of higher education to train a breed of engineers to be active learners, then it becomes important to encourage active participation in all aspects of learning, especially in large tutorial classes where the problem has surfaced and being identified. However, the "submissive behaviour of Asian students in the family" and the "stage fright" syndrome will hinder students from performing in front of large audiences. The passive habits of students will also affect their attention spell in the class. This paper has proposed a number of factors which can be employed to encourage active learning to take place in a large tutorial class. These include the encouragement of active participation, giving clear objectives and expectations and the establishment of psychological contract right from the beginning of the course, keeping and sustaining the students' interest through the use of improved teaching aids and innovative techniques.

Disclaimer

This article does not necessarily reflect the beliefs of the authors' employing education authority.

References


