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Short Notes on Classroom Innovations

"Ways of getting your hands dirty": Activity-based tutorials as a strategy for enhancing interactivity in large general-education classes

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“Ways of getting your hands dirty”: Activity-based tutorials as a strategy for enhancing interactivity in large general-education classes

CONTEXT

Background

At present, the National University of Singapore (NUS) offers over a hundred general education (GEM, GEK: *General Education/Knowledge Modules*) modules, covering a broad range of topics. GEMs are part of the NUS curriculum to foster well-rounded, balanced and holistically developed individuals. GEMs are more ‘broad’ than ‘deep’, and are meant for students to explore, experience and perhaps even develop a new appreciation for topics that they would otherwise shy away from.

A typical GEM can have hundreds of students from across the faculties and years of study. This diversity of background and experience often implies a lack of prior training or a lack of interest, which can make it challenging for a topic to be developed to a greater depth. A good example of this is a GEM dealing with a topic in science that requires mathematical concepts, but which attracts students from the humanities. The situation is made more challenging by the general (yet unofficial) perception (by both faculty and students) that, by their very design, GEMs should be less serious and less demanding of time and effort. They are also expected to have more than a fair share of entertainment value. Realistically, such a view is not unreasonable given that students are being forced to move out of their comfort zone to explore something that they may perceive as being outside their ken or not worthwhile. The onus then falls upon the teacher to make the best of this opportunity to generate interest in the topic, and to convert these ‘uninitiated’, ‘non-believers’. Fortunately, this can still be achieved by retaining the good teaching practices advocated by the gurus of pedagogy, albeit at the expense of academic rigor.

The following is an account of a strategy carried out to achieve good, engaging learning within the context of a GEM’s multifarious student population. This was implemented in a GEM from the Department of Physics (GEK[1548], ‘How the Ocean Works’) dealing with oceanography. One hundred and forty-seven students from the following faculties enrolled for the module.

Faculty	% of students
Faculty of Arts & Social Sciences	40
Faculty of Science	40
Faculty of Engineering	9
NUS Business School	8
School of Design & Environment	
Yong Loo Lin School of Medicine	3
Multi Disciplinary Programme	

Course objectives

These include:

1. Grasp challenging (mathematical or abstract) science concepts.
2. Make the learning of science enjoyable, fun and memorable.
3. Engage in efficient peer learning.
4. Learn from mistakes or misconceptions.
5. Network with students from diverse faculties.

On the one hand, the diverse backgrounds of the students created some challenges, but on the other hand, they allowed us to aim for some unique learning outcomes (e.g. item 5). This might not be so readily attainable in a typical course that consists of a cohort focused on a single specialisation.

THE STRATEGY

Rationale

Biggs and Tang (2011), in their book *Teaching for Quality Learning at University*, define good teaching as follows: “Good teaching is getting most students to use the level of cognitive processes needed to achieve the intended outcomes that the more academic students use spontaneously”. Taking into account the context of a GEM (diverse backgrounds of students, levels of commitment, levels of training, and individual differences with regard to the perceived value of the course), we attempted to activate the cognitive processes by adopting a less intellectual, less abstract but more hands-on approach that was engaging and interactive, and which provided students with the opportunity to learn as a collective of like-minded individuals who were not necessarily specialists in the topic. ‘How the Ocean Works’ had several teaching and assessment modes namely, biweekly lectures, weekly tutorials, weekly online engagement, in which 10 questions were answered by students through the Integrated Virtual Learning Environment (IVLE) and a student group presentation. The mode that was targeted to achieve the above objectives was the tutorials.

Traditional Tutorials

Traditionally, tutorial slots were used to discuss solutions to a set of questions provided to students. A typical tutorial setting was a 'traditional' classroom equipped with a whiteboard and/or projector where a teaching assistant discussed the questions as well as the solutions. The onus fell on the teaching assistant to make the tutorial sessions interesting, interactive and conducive to learning. Grades were awarded by the teaching assistant for participation or for attendance to the tutorial session. As the traditional tutorial format had not achieved its goal, we decided to repackage the tutorials.

Giving Tutorials a Twist – Activity-based Tutorials (ABT)

On paper, a typical tutorial slot lasted for an hour; however, each realistically lasted approximately 40 minutes – due to the University's policy of allowing travel time between classes. Each session of 'How the Ocean Works' had about 25 students. The 'traditional' tutorials were replaced with *Activity-based Tutorials (ABTs).* Some of the features of ABTs included:

Feature 1: Small, hands-on experiments (activities)

> In place of a set of questions that the students had to provide answers for, the 'new' ABT consisted of mini, hands-on experiments (activities) that the students had to perform, in order to answer the questions or to understand a concept. A typical activity took about 15 minutes to work through and each session had three different activities. Each activity was set up in triplicate so that an activity could be done in parallel by three groups. The schedule was arranged such that, every fifteen minutes or so, the groups were asked to proceed to the next activity.
>
> Below are a few examples of the activities:
>
> **See the sun through a bulb**
>
> To estimate the power of the sun using a bulb.

Straight or curved

To understand the Coriolis effect using a rotating platform and some coloured pens.

Make a soda can float

To measure the sugar content in a can of Coca-Cola by making it float, achieved by dissolving its salt content.

Ice melt

To understand the role of salinity and temperature in ice melt.

Join the seismic dots

To use coloured pens to mark seismic events on a world map to show the distribution of the tectonic plates.

Feature 2: No prior preparation required

Each activity came with a worksheet that contained the following: learning objectives, instructions on how to perform the activity and what equipment was necessary, safety concerns and questions that the students had to answer. Students wrote down their answers in the spaces provided within the worksheets and they were encouraged to retain these sheets.

Feature 3: Smaller, ad-hoc groups

The 25 or so students from each session were further divided into smaller groups of about three students. The rules for creating a group were very relaxed, but students from different backgrounds who previously were not acquainted were encouraged to form a group. Students who wished to form their own group were allowed to do so. The maximum number of groups was limited to nine to match with the three parallel activities.

Feature 4: Held in a big, open lab

The tutorials were held in a big, open laboratory that allowed students to walk around, discuss, exchange opinions, and interact. This setting allowed students to share their experience about an activity with the next group; thereby promoting exchange of ideas. This setting also allowed the instructors to walk around and interact more directly with the students in the class.

Feature 5: Immediate feedback for students

The opportunity for students to freely discuss and exchange ideas about activities allowed for immediate feedback on how they were learning. Furthermore, the teaching assistant and the lecturer (instructors) attended each tutorial session. The role of the instructors was to walk around and help students who were having difficulties or to prompt students to think about certain aspects of the experiment; activities *were scaffolded* so that the *students could get to understand many of the fundamental concepts on their own*.

Feature 6: The tutorials carried no marks

Although attendance was taken, no marks were allocated for attendance or submission of the worksheets used during the sessions. This 'no marks' policy was adopted so as to free the students to experiment and explore the activities, unburdened by worry about marks – a strategy we hoped would enhance learning. This also allowed students to make mistakes during the experiment and in their reasoning; and then to learn from them. For this learning mode to work, however, it was important that the instructors were around to provide appropriate feedback.

A possible downside to not having scores was that the students might not take the activities seriously or might not even attend the sessions. We tried to mitigate this by reminding students that the materials covered in the tutorial sessions were testable. In spite of this 'no marks' policy, the attendance at the tutorials (averaged for the whole semester) was approximately 90%.

ABTs are not laboratory sessions

In introducing these ABTs to the students, we were careful not to describe them as 'laboratory experiments'. They were introduced as 'fun activities' or 'ways of getting your hands dirty' with the aim of strengthening/aiding the comprehension of concepts already discussed or those that were to be discussed in the near future. That these activities were laboratory experiments was only by design. They did not demand the rigor (precision in measurements, methodology, instrumentation, laboratory reports) that was expected from an experiment in a physics laboratory. Having such expectations would have been unfair and unrealistic considering the diverse background of the students.

REFLECTIONS

Invaluable Feedback for Faculty

The ABTs had a great side benefit to the faculty members in that the enhanced interaction allowed him/her to generate greater awareness as to how the module was being received by the students. This feedback was invaluable to tailor, reiterate or reemphasize content in the lectures in order to make learning more effective.

Challenges

Setting up and running these interactive tutorials were labour- and resource-intensive. Unlike traditional tutorials where questions may be sourced from text books, ABTs required much more preparation and planning, which included not only to set up the experiments but also to source and purchase the necessary equipment.

Student Comments

The end-of-semester student feedback is shown below. Not all of the statements advocate the ABTs, but nor do any completely reject them.

> Comment [1]: "It is a good exposure module on the different aspects of the ocean that we often overlook. It is very interactive with the hands-on experiments and demonstrations during class. It is manageable with sufficient formulation and calculation."

> Comment [2]: "As a physics GEM, this module while having its portion of equations, focuses more on their applications and effects on the world and in particular the oceans. As such it had the ability to cater to students of various backgrounds. The tutorials were fun and helped greatly in displaying some of the concepts taught in class. "

> Comment [3]: "Strength: Topic is very interesting and makes people ponder more about surrounding more. Tutorials are more hands-on, allow us to apply what is taught in lecture and see that it is true."

> Comment [4]: "(+) The module was the MOST interesting one I've had. It was amazing how the earth was put together, and it is amazing learning how the earth works! (-) There is no need for tutorials. (-) LESS CALCULATIONS. Why was the test so full of calculations? Test [2] was way too difficult."

> Comment 5: "Strengths: Interesting new module, something different. Project topic is flexible, allowing students to be able to explore ideas and concepts beyond what is taught. Weakness: Sometimes the link between what is taught and the module is not very clear. Possible improvements: Could do without the tutorials"

CONCLUSION

Although we did not conduct a quantitative study of the effectiveness of the ABTs, each ABT session seemed a success owing to the peer interaction, discussion and excitement that was observed. In addition, the faculty-student interaction was invaluable for the faculty members to gauge the effectiveness of the lectures and gain invaluable feedback. On the whole, this has given us the motivation and the encouragement to continue with the ABTs in future installments of 'How the Ocean Works'.

REFERENCES

Biggs, J., Tang, C. *Teaching for quality learning at university.* 4th ed. Open University Press; 2011.

National University of Singapore. List of all General Education Modules; 2013. Available from: http://www.nus.edu.sg/gem/GEMs_offered.pdf