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Enhancing students' engagement through effective feedback, assessment and engaging activities

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Abstract

This paper is about students' perceptions of mathematics and statistics and their impact on students' engagement, enthusiasm and academic self-efficacy.

I will discuss the strategies I developed to improve learning and teaching in statistics and mathematics service course classes, consisting of 15 students each, some of which also worked extremely well in my lectures to large audiences of about 350 students.

I would argue that such an approach could not only enhance students' perceptions of the subjects and their engagement in classes/lectures but also promote critical thinking, independent learning, reasoning and several transferable skills associated with university education.

I will share the outcome of my teaching approach which not only fulfilled my initial expectations but far surpassed them. It increased students' engagement and their enthusiasm which improved their performance in class activities and coursework. Furthermore, it improved students' perceptions and attitudes to mathematics and statistics as reflected in their feedback. I have included some of their comments to highlight the impact a teaching approach can have on students.

Background, Approach and Methodology

When I became involved with class teaching after a period of lecturing, I started with an approach that seemed logical and natural to follow, which is to hand out the marked weekly homework assignments and work through the questions.

My observations and concerns

- a) Students seemed unhappy with the pace of delivery in classes mainly because of the diversity in their abilities as a result of the variety of their academic and cultural backgrounds. Furthermore, students' expectations of teachers and their individual learning styles/needs differed. De Vita and Case [1] recommend that this diversity creates an opportunity *"to reflect on and rethink not only what we teach but also how we teach."*
- b) Some students found it hard to handle the information overload in lectures and felt rather overwhelmed.
- c) Students generally found the course lengthy, tedious and irrelevant to their respective career paths.
- d) Some students had low academic self-efficacy which acted as a barrier to learning.

"...students are likely to have trouble with statistics due to non-cognitive factors, such as negative attitudes or beliefs towards statistics. Such factors can impede learning of statistics..." [2].

The Teaching Quality Assurance and Review Office (TQARO) Qualitative/Quantitative survey results acted as a trigger for prompt action, as they confirmed my perceptions.

I wanted to devise a teaching approach to address these issues by drawing from;

- i. my past teaching experience
- ii. several theories of learning
- iii. students' feedback.

Main hypothesis

Improvement in the teaching and learning climate will enhance student engagement.

Additional points which shaped and developed my approach

I started with a pragmatic approach drawing from students' informal/formal feedback. Furthermore, I used students' responses to optional open-ended questions to gauge changes in their perceptions of mathematics/statistics. I found students' informal, unprompted and spontaneous feedback of immense value.

As I started to modify my teaching approach, I expanded my original hypothesis by adding further points for consideration that were the combined outcome of my observations, feedback and my reflections on the iterative process:

- A variety in teaching approaches, formative assessments and class activities may improve the teaching and learning environment, facilitate effective learning and enhance academic performance.
- Group activities may improve the social climate of classes, improve the student-teacher rapport and promote statistical/mathematical thinking/reasoning.
- Carefully designed formative assessments followed by instant feedback may enhance students' academic self-efficacy and interest in the course.

My teaching approach

I use multiple choice questions (MCQs), short questions and group activities to encourage students' participation. An important consideration while designing questions is the diversity of students' cultural and academic backgrounds. Culture provides learners with a means of thinking which is referred to as the tools of intellectual adaptation by Vygotskians. *"It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as*

determined through problem solving under adult guidance or in collaboration with more capable peers" [3].

MCQs can be successfully used to assess a variety of learning outcomes relating to all of the competences in Bloom's taxonomy [4]. I use these as diagnostic as well as formative assessments to fulfil three main purposes;

- i. highlight problem areas and individual learning needs
- ii. clarify key concepts and terminology in the course material
- iii. promote active learning

"I have observed that students' academic self efficacy levels are enhanced when they get answers to the multiple choice questions correct. Even if they get them wrong their understanding improves because of the explanation that follows immediately in the form of instant feedback."

I begin my classes with one or two MCQs/short questions focusing on key concepts of the material covered in the previous lectures. This captures students' attention and puts them in a receptive frame of mind. I display the answers giving them a brief explanation after a few minutes. This helps them link new concepts with their existing knowledge and they generally seem to appreciate the benefit of using MCQs. *"One thing I like about the classes is that you expose us to more questions; even though at the time they can be annoying in the sense that they seem complicated, I think that they will act as triggers for memory in the long run"* (student).

I have observed that students' academic self efficacy levels are enhanced when they get answers to the MCQs correct. Even if they get them wrong their understanding improves because of the explanation that follows immediately in the form of instant feedback. MCQs can achieve a lot if designed carefully, focusing on the learning outcomes of the course. *"... I am now much more familiar with the combinations formula, and the Binomial distribution; Overall, I'm thoroughly enjoying myself and my understanding of stats is growing"* (student).

I have successfully used MCQs/short questions in lectures at the beginning, half-way through and at the end of lectures to break their monotonous nature, introduce interaction, make the pace of delivery manageable and avoid information overload. The cognitive structure of the working memory is limited in its capacity and duration [5].

I combine verbal feedback on their homework with a brief recap of related concepts and key points. I point out common misconceptions making constructive comments to avoid their future recurrence and advise students to annotate their scripts for their reference. I e-mail them detailed solutions the evening before each class, to help them reflect on these and seek clarification on their queries in class. Students appreciate the interactive nature of such feedback and use the opportunity to improve their understanding. **"I enjoy the classes as they are good in terms of feedback on our assignments and they provide a more detailed explanation of the course material..."** (student).

Their perceptions of the course improve as they begin to view the subjects positively. **"I used to dislike Statistics. However I do really enjoy the course now..."** (student).

The above quotes show how students' self-efficacy contributes significantly to their attitudes towards the course and may significantly contribute to their academic progress. **"Efficacy beliefs influence how people feel, think, motivate themselves and behave"** [6].

I include a glossary of statistical/mathematical terminology in my recap to help students;

- i. relate the terms to the right meaning
- ii. contextualise the terms

Biggs [7] explains that **"Elaborating the material, removing misconceptions, applying to specific examples, comparing different interpretations are left to the complement of the lecture, the tutorial."** Students definitely seem to view this positively. **"...your slide shows summarising in a few lines and in a simple way the main points of the previous lectures are extremely important in reminding us of the material and getting us in the mood of the lesson"** (student).

I ask students to attempt new problem solving questions advising them to work in pairs/groups. This promotes a positive learning climate, increases student participation, encourages student-teacher dialogue and facilitates deeper learning.

Furthermore, it gives me the opportunity to see students individually and address their queries effectively. Group work helps them develop interpersonal skills, effective communication, team working, and the ability to effectively contribute to discussions. Solving complex problem questions in groups enhances their understanding of the theoretical concepts and promotes deep learning as they often require the students to convince their peers of a specific approach to problem solving. **"I now fully understand the Combinatorics and Binomial theorem"** (student).

I end my classes/lectures with a short question on the material covered asking students to reflect on it. This continues the exchange of ideas amongst students beyond the classroom maximising the benefits of their intellectually

stimulated and receptive frames of mind. Good dialogue elicits those activities that shape, elaborate and deepen understanding [7]. Such interaction is very enriching for both home and overseas students because it helps develop a global perspective and global citizenship across the institution [8, 9 and 10].

I will continue to review and modify my teaching approach to match the changing global landscape of higher education.

Future

I should like to further research the theme and explore possibilities of extending my hypothesis.

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