Reinforced learning through video assignments for electromagnetic theory subject

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ABSTRACT –The objective of this paper is to investigate the concept of reinforced learning through active involvement via video assignment in order to complement the lecture sessions The Electromagnetic Theory subject has been chosen as it is considered to be a tough subject that cannot rely on rote memorization Students from two sections are used as sample where S1 is given the video assignment while S2 is not. Results show that S1 performs substantially well compared to S2 in the final exam for the related topic. Students also state their perceived understanding of the topic due to the assignment.

1. INTRODUCTION

Traditional lecture sessions is still the main teaching strategy used by most universities today. Proponents would argue that lecturing allows the subject matter experts (i.e. lecturers) to present facts and information in a one-way communication first to lay the foundations required to understand a subject [1]. The students can then interact with the lecturers to enquire, clarify, and even challenge the materials presented. It is still considered by many to be the most cost-effective way to disseminate information and initiate the learning process over large class sizes.

On the flip side, those who oppose this idea claim that lectures has become obsolete, in part due to how easy it is to tune out from lecture sessions while giving the impression of paying attention. The duration of the lectures, which is usually between 2 to 3 hours also conflict with the general consensus that students' attention span ranges only between 15 to 20 minutes although there is no empirical evidence to support this [2]. The number of lectures per day which can be up to five different subjects, compound the problem even more as students are too tired mentally to process information even if they put genuine effort to study.

The past two decades has seen a shift from the conventional teacher-centered learning towards student-centered-learning. Strategies such as problem-based learning and peer-led teaching have been used. Technology has also been deployed ubiquitously to deliver content without the need to be physically present and to enable student to study at their own time and pace [3].

This paper investigates the idea of improving students' learning by 'forcing' them to learn and indirectly teach their peers about a certain topic through video assignments. This activity is inspired through the constructivism learning theory proposed by [4]. The hypothesis is that through this method, students will have a more genuine understanding of the topic, reflected by their exam results.

2. METHODOLOGY

The subject chosen for this study is BEKP 2453 Electromagnetic Theory, a compulsory subject for undergraduate pursuing an Electrical Engineering degree. The subjects is considered by many to be one of the toughest subjects in undergraduate course, as it requires strong mathematical ability, particularly in calculus, as well as the ability to visualize abstract concepts. There are more than two hundred equations throughout the subject, making rote memorization impractical. The topic chosen for this study is Electrostatics, which is further divided into 23 sub-topics covering the key concepts.

2.1 Sample

The sample comprised 148 4th-semester undergraduate students for the 2017-2018 academic year. They are divided into two sections, Section 1 (S1) has 69 students while Section 2 (S2) has 79 students. Both sections have a healthy mix of genders and ethnicity and all are within the same age group.

2.2 Assignment Criteria

Each student is assigned to a group with a maximum number of five per group. The group is then assigned to a subtopic randomly. The assignment is divided into two parts. Part one is the explanation of the key concepts for the given subtopic. Part two is showing how to solve questions with complete solutions. The students are free to divide work among them but all must show active participation in the video. Another important point is that students are not allowed to copy paste examples already available in reference text books and lecture notes.

The video assignment is assessed based on the clarity of explanation and the quality of the solution. Their level of understanding is then assessed through

their ability to answer Question 4 (Q4) in the final exam at the end of the semester.

3. RESULTS AND DISCUSSION

Prior to giving the video assignments, the student has gone through the mid-semester test where there was also a question dedicated to the Electrostatics topic but only covered a few early subtopics. The results provide an indicator to evaluate student performance. Comparison between S1 and S2 is shown in Figure 1. The horizontal axis represents the score percentage from the total mark. In the test, the total mark is 10, so students who scored above 8 are labelled as ">80%" and so on. The reason it is converted into percentage is so that it can be compared with the final exam result in Figure 2.

Here it can be seen that S2 outperforms S1. More than 20% of S2 students scored above 80% of the marks while S1 only managed to achieve 8.9%. 60% of students manage to get above 60% of marks while for S1, it is only 34.2%.

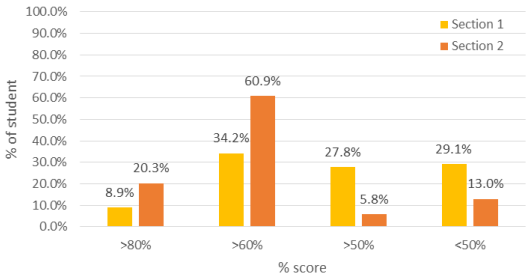

Figure 1 Performance in test according to section.

Meanwhile, Figure 2 shows the performance of the student in the final exam for the question on electrostatics. Surprisingly, the results are now flipped. S2 showed poor ability to answer the question, with close to 80% of students unable to get half of the total marks. On the other hand, S1 students showed a slight improvement for students scoring above 80% while all the other ranges has small changes.

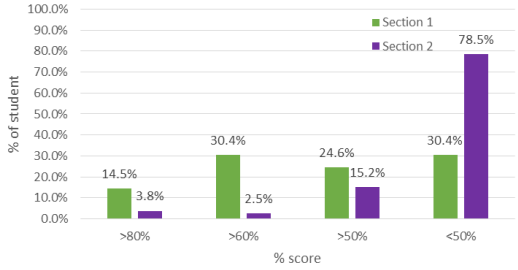

Figure 2 Performance in final according to section.

Figure 3 summarizes the overall performance in test and finals for both sections. The most obvious observation is that the number of students who could answer the test question with scores larger than 80% and 60% plummets when they answer the same topic in the finals. As for S1, the performance is roughly the same, although there is also a slight increase in the percentage of students scoring below 50%, and marginal drops for students with intermediate scores, the percentage of students scoring above 80% is significant.

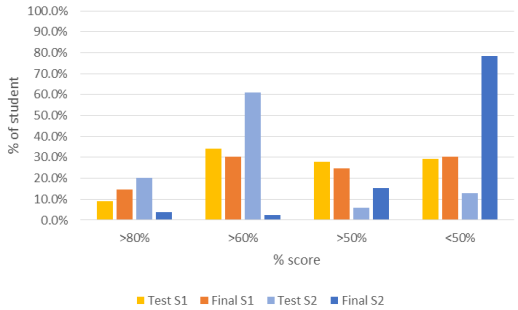

Figure 3 Overall performance for S1 and S2.

A simple questionnaire was conducted online for S1 students to gauge their perception on whether the video assignments have helped them understood the topics better. The result is shown in Table 1. A majority of the students stated that in fact the videos did help them as it forces them to explain rather than passively reading the material.

Table 1 Questionnaire on student perception

Does the video assignment help you understand the topics better?

Answer	No of students	%
YES	58	84.1
NO	2	2.9
UNSURE	4	5.8
Did not answer	5	7.2
Total	69	100

4. CONCLUSION

The findings indicate that through deliberate reinforced learning, students were able to sustain their knowledge on the topic and this may signify the potential of implementing it to enhance student learning. However, the authors are fully aware that correlation does not mean causation. A multitude of factors could have caused the results mentioned above which has not been scrutinized thoroughly. However this work is hoped to trigger further research on this matter to improve overall student learning experience.

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