Student Perceptions of the Impact of Using the Flipped Classroom Approach for an Introductory-level Multidisciplinary Module

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Introduction

During the last decade or so, there has been a gradual but continuous shift in how learning is accomplished in a classroom. With the advent of new pedagogical techniques, more and more faculty members are adopting the blended approach to attain and improve students’ learning experience (Ragupathi, 2013; Hughes, 2012; Bonk & Graham, 2006; Friesen, 2012). The “blended learning” approach synergistically brings together the compelling aspects of online, classroom and mobile learning to enhance student’s engagement and participation in a classroom and also helps attain the predetermined learning outcome measures. The “flipped classroom” is a type of blended learning approach where the onus of learning and mastering content falls back to students. For these approaches, the teacher’s role has gone through a metamorphosis—from being the “sage on the stage” to the “guide by the side”, and classrooms are changing as well, from the traditional and passive teacher-centred learning environment to an active student-centred one with the teachers assuming the role of facilitators (Lage et al., 2000).

The underlying idea and approach of delivering flipped content includes developing a pre-recorded video encompassing the fundamental theoretical concepts of a particular lesson, which the students can watch outside of classroom time at their leisure to gain some idea about the topic covered in next lecture (Bishop et al., 2013). This helps the instructor by freeing up classroom time, which may be used for active learning activities such as in-class discussions, answering questions and group activities. Prior to embarking on the project, I identified a significant knowledge gap (based on the lack of published articles on this subject) in terms of the acceptability and adaptability of the flipped classroom concept among students, particularly at introductory-level multidisciplinary modules, which I sought to study in this particular project.

Implementation Methodology

It is widely accepted that when it comes to viewing video clips, the interest of students as well as their ability to comprehend the information presented in a video clip decreases with an increase in the clip’s duration. More specifically, in my opinion students tend to learn better and retain more of the information

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presented when the length of the video is 10 minutes or less. Taking this into consideration, I experimented with the flipped classroom approach in the introductory and interdisciplinary module GEK2505 “Introduction to Biomedical Engineering”, which had a total enrolment of 12 students. An introductory video of about 8 minutes was uploaded on IVLE about a week ahead of the lecture. The video encompassed the fundamental and theoretical aspects of the field of biomaterials. As many of the students taking GEK2505 were not from a science or engineering background, the introductory video gave them a fundamental overview of biomaterials. All the students were encouraged to view the video prior to the lecture so that they could do some reading/research on their own and come to class with questions that may be discussed during lecture time. To my satisfaction, most of the students had viewed the video at least once, which was obvious from their active participation and response to my questions during the actual lecture. A part of the ensuing lecture time was devoted to group activities and brainstorming, which are hallmarks of the flipped concept.

Students’ Response Towards the Flipped Classroom Approach

Based on an analysis of the student feedback conducted and collected from all the students who took GEK2505, we were able to group their qualitative responses towards the flipped concept under a few key points, as discussed in the next few sections.

*Flipped Classrooms Facilitate Student Learning and Preparation for the In-class Lecture*

The flipped classroom approach facilitates student learning and preparation for the in-class lecture session. As some students shared in their feedback, they found this approach useful in helping them be better prepared for the discussions during the lecture:

- “I like the [flipped] concept because we can have more time to go through the video and research before going for the lesson. The lesson will thus be more interactive and beneficial.”
- “The video was a good introduction to the lecture...I like the concept and I feel it will be beneficial to my learning curve.”
- “It allows students to utilise their time more efficiently.”

Students also recognised the benefits of being able to revisit the online resource (in this case, the video) pre-lecture. In fact, several students indicated that they found the ‘pause’ and ‘rewind’ functions in the video recording very useful in helping them revisit points in the lecture, something which is not possible to do so in a lecture delivered in the conventional way.

*Flipped Classrooms Promote Active and Deeper Learning During In-class Interactions*

Students also recognised and appreciated the fact that participating in the lecture’s active learning activities (e.g. group discussions and brainstorming activities) was beneficial to their learning:

- “It encourages active learning in the classroom.”
- “Open courseware or flip classroom concept is a fantastic idea which is well suited for people who are more inquisitive and get tired with lectures that aim to simply convey content.”

I also observed students being able to apply what they learnt beyond the lecture session. During the tutorial which immediately followed the exam for GEK2505, students were able to use the knowledge they gained from watching the video and participating in the learning activities during the lecture to come up with a novel design for a potential biomaterial to address a particular clinical scenario.
Students Were Willing to Adapt to the New Learning Approach

Some students responded that they are willing to adapt to and adopt the new pedagogical technique; they would like to see educators/lecturers implement the concept in other modules as well:

- “Although I have some concerns, I would like to see wider implementation of the flipped classroom concept.”
- “It allows the educator to experiment with more hands on stuff, instead of just going through theory of the subject taught and we should continue experimenting.”

Student Perceptions of the Flipped Classroom Approach

In addition to giving qualitative feedback, students were asked to respond to a series of statements (see Table 1) to gauge their understanding of and response towards the use of the flipped concept in the module, based on whether they agree, disagree or were neutral/did not respond to the specific statement (see Figure 1).

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Table 1. Statements used to gauge students’ interpretation and response towards the flipped concept.

<table>
<thead>
<tr>
<th>Question</th>
<th>Statement</th>
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<tbody>
<tr>
<td>A.</td>
<td>I like the flipped pedagogical concept, ie, the recorded pre-lecture videos, as it introduces us to the topic to be discussed during the subsequent lecture.</td>
</tr>
<tr>
<td>B.</td>
<td>I like the traditional lectures only, without the videos.</td>
</tr>
<tr>
<td>C.</td>
<td>A judicious combination may provide a better learning experience.</td>
</tr>
<tr>
<td>D.</td>
<td>I prefer the videos only and the lecture time may be used for hands-on activities, discussions etc.</td>
</tr>
<tr>
<td>E.</td>
<td>Although I have some concerns, I can and am willing to adapt myself to the new pedagogical technique.</td>
</tr>
<tr>
<td>F.</td>
<td>We should continue experimenting/implementing this new pedagogical technique in this and other modules.</td>
</tr>
</tbody>
</table>

Figure 1. Graphical representation of the students’ interpretation and response to the statements in Table 1.
According to the results collated in Figure 1, an overwhelming majority of the students (90%) agreed with Statement A, that is, they liked the flipped concept. In addition, every student who participated in the exercise preferred a judicious combination of the in-class lecture and an element of the flipped concept (Statement C). Meanwhile, almost 70% of the students responded that while they harboured some concerns about the concept, they were nonetheless willing to adapt to the new pedagogical technique (Statement E). Their concerns were primarily related to whether participating in flipped classrooms would result in an increase in their workload, whether it adds value to the learning outcome as well as its appropriateness to enhancing teaching effectiveness in larger classrooms. Nonetheless, once they were convinced of the immense potential of the technique, more than 90% of the students agreed with Statement F, that the instructors should continue experimenting with and/or implementing this approach in this and other modules.

**Student Learning Outcomes Achieved**

Towards the end of the instructional period, we evaluated students’ understanding of the fundamental concepts covered in the module via a written exam. The exam contained a combination of multiple-choice, “fill in the blanks” and “true-false” questions. The questions were set in a manner that students who watched the video and had participated in the in-class discussions may have an advantage over those who did not. To my satisfaction, most of the students did well in the exam. Thus, by applying the flipped classroom approach for GEK2505, I was able to convert the lecture time to a platform for active learning where students had the opportunity to discuss relevant aspects of biomaterials, which helped me attain my pre-identified student learning objectives.

**Key Lessons Learnt**

Based on the qualitative and quantitative feedback provided by the students as well as my own reflections, in the following sections I will address some of the issues I faced during the implementation of the project, and my suggestions to manage them for future cohorts taking GEK2505.

**Getting Students Motivated**

**The Issue**
Some students perceive watching the video before the actual lecture as an additional workload which may act as a deterrent to watching it. How can we motivate students to watch the video?

**Suggestion**
It should be articulated to the students early and clearly that the primary objective of having them watch the video before the actual lecture is to help them optimise the expected time they are required to study on their own. Moreover, the video clip will not be too long (usually less than 10 minutes) and will focus on the fundamental and theoretical aspects of the lesson. The material covered in the video will also not be too difficult to comprehend. To further motivate students, I told them that towards the end of the video, I have included a list of companies which may be their potential employers once they graduate.

**The Issue**
How do we ensure that students have watched the video?

**Suggestion**
This may be accomplished by introducing simple online quizzes based on the video content with pre-set deadlines for completion. These short quizzes may also be administered just prior to the lecture. The students should
be made aware of this aspect of assessment at the start of the module and it should not come as a surprise. As such, it needs to be conveyed clearly that the quiz would be based on the video content and students who have viewed and understood the concepts highlighted in the video would be at an advantage as far as answering the quiz is concerned. Students’ performance in the quiz may be included as part of their continuous assessment (CA). In my opinion, we as lecturers/educators have to devise a mechanism to incentivise students who go the extra mile and make this extra effort. The quizzes should be designed to reward students for their diligence. In lieu of the quiz, they may also be asked to write a half-page reflection on the video for which they may be awarded some participation marks.

**Applying Just Flipped Classrooms is Sufficient to Achieve the Learning Outcomes**

**The Issue**

Would using only the flipped classroom approach be sufficient to achieve the module’s pre-identified learning outcomes?

**Suggestion**

In my opinion, the flipped concept should be part of the entire educational package, used in conjunction with other modes of instruction and conveying information, like in-class activities, getting in guest speakers or providing consultations to individual students etc. Getting early exposure to new teaching methods can open the minds of students and makes them more receptive to them. Hence, foundational modules may be taught using this concept for early exposure. Striking a balance between traditional and new pedagogical methods would be necessary to optimise student learning.

**Incorporating Relevant Online Content to Achieve the Module’s Learning Outcomes**

**The Issue**

What should the instructor include in the video that would achieve the module’s learning outcomes?

**Suggestion**

The video should encompass fundamental and theoretical aspects of the subsequent lecture. For this particular video, I included a list of topics that would be covered followed by some basic definitions, relevance and importance of the topic, areas of ongoing research and significant findings, lots of practical examples and their images (if feasible) and eventually, a list of companies engaged in similar research areas which may be the students’ potential employers. This also helps motivate the students to attend the lecture and in doing so, become more active participants rather than passive listeners, thus helping the instructor to attain the module’s learning objectives.

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**About the Author**

Dr. Mrinal Musib teaches several modules in the Dept of Biomedical Engineering related to tissue engineering as well as cellular and introductory bioengineering. He is also involved in tutoring students in the engineering professionalism module. He believes that student learning outcomes can be achieved by leveraging on the synergistic benefits of implementing the flipped concept in conjunction with traditional teaching methods.
Using Online Resources to Scaffold Learning

The Issue

Using online resources, such as the video, to scaffold learning.

Suggestion

As mentioned earlier, the video was made so that students would enjoy viewing it; the video content was also conceptualised such that it was easy to comprehend, even for students who are not from science or engineering backgrounds. Nonetheless, any questions students may have about online resources, such as the video, may be addressed prior to the beginning of the lecture and before the quiz is administered. If all the students taking the module make the effort to watch the video before attending the actual session, they would be on a common knowledge platform or on the ‘same page’. As such, they are likely to become more engaged and participate actively during the actual lecture. The in-class activities (either during or following the lecture) were designed in a manner which allow for scaffolding of learning as well as giving students the opportunity to apply the knowledge they gained during the lecture.

Conclusions and Future Directions

The results of the experiment showed that the majority of the students who took these modules responded positively to the flipped classroom approach and they preferred faculty members to continue experimenting/implementing this concept in other modules. In my opinion, the flipped concept has a great potential to enhance the student learning experience. In addition, it has helped me save lecture time by allowing me to provide students with a topic’s fundamental concepts as a video prior to the lecture, which students can watch on their own time.

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