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IS A FLIPPED LEARNING APPROACH SUITABLE FOR PART-TIME ENGINEERING STUDENTS AT TERTIARY LEVEL EDUCATION?

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Abstract

In a flipped learning model, teachers shift traditional educational arrangement outside the classroom and make teacher-driven instruction to student-centered learning. Meanwhile, students are the agents of their own learning and typical lecture and homework elements of a course are reversed. Very often, flipped classrooms are designed for secondary schools and for full-time courses and programs. As there has been growing interest in incorporating flipped learning into higher education, this calls for more high quality researches to inform practitioners on the use of flipped learning in different study modes. Rarely have they been examined in tandem with part-time study mode, this paper provides information on previous research studies and outlines benefits and major challenges of flipped learning particularly for this study mode. An investigation of a part-time higher diploma engineering course at Hong Kong Institute of Vocational Education (Tuen Mun) has been conducted. It reveals the learning needs in which flipped learning approach would have benefited their studies somewhat. The results of this investigation have been used as the basis for developing the course to allow a more effective flipped style. Pedagogical implications are drawn from the analysis and the way forward.

Keywords: *flipped learning, part-time, engineering study, tertiary education, vocational education*

Introduction

Pedagogical approaches such as Problem Based Learning (Kelly and Lesh, 2000), Model-Eliciting Activities (H. A. Diefes-Dux et al., 2004) and Peer Learning (H. A. Diefes-Dux and M. A. Verleger, 2009) have been introduced for teaching engineering students at tertiary level education. Recently, flipped learning approach has been the subject of much popular attention, however, very little research has been undertaken into these approaches.

In a flipped classroom, the information transmission component of a traditional face-to-face lecture is moved out of class time and in its place are active, student-centered and collaborative tasks. Before class, students have to prepare for class by engaging with resources that cover what would have been in a traditional lecture. After class, they could follow up and consolidate their knowledge. Notably, flipped learning has proven to be effective in secondary schools and in freshman engineering level (Yelamarthi et al., 2015). While past research studies have addressed many benefits of implementing flipped learning in full-time study mode, the flipped classroom approach in part-time study mode is under-evaluated, under-theorized and under-researched in general. Despite popular enthusiasm and a somewhat reasonable rationale, flipped classroom approach could not yet be considered an evidence-based (Pawson, 2006) approach, especially in consideration of different level of commitment by part-time students.

Vocational Training Council (VTC) is the largest vocational and professional education and training provider in Hong Kong. In academic year 2015/16, VTC has offered about 44,900 full-time and 21,500 part-time study places through its member institutions. Aiming for high quality researches to inform practitioners on the use of flipped learning in part-time study modes, the purpose of this study can be defined as the followings: 1) To provides information on previous research studies; 2) To address benefits and challenges of flipped learning for part-time students; 3) To propose best practices to design and implement flipped learning.

Research Questions

Part-time programs have a very different level of commitment than full-time programs do. Full-time students are expected to treat their studies as the main focus while part-time students might take one class a week, requiring only a couple hours of out-of-class study time.

From a cognitive load perspective, self-paced preparatory work might better manage working memory than traditional lectures (Clark, Nguyen, & Sweller, 2005). According to Andrews, Leonard, Colgrove, and

Kalinowski (2011), many of the learning difficulties experienced by students in higher education courses can be attributed to the passive role played by them during traditional lectures.

Flipped classroom approach wagers the success of in-class activities on the likelihood of students completing their pre-class assigned work and this leads to the perennial problems of student preparation. More troubling are issues of student motivation and imagine a flipped classroom where none of the students have completed their pre-class work. Based on such circumstances, how do teachers ensure students have prepared, and if the preparation in a flipped learning approach is useful for part-time engineering students at tertiary level education?

Research Methods

In academic year 2015/16, flipped learning approach was introduced to two compulsory engineering science modules, namely ENG3012 Engineering Science B and CON3301 Engineering Science for Construction A. The class of former one was in full-time mode of 28 students, while another was in part-time mode of 20 students. Both modules were foundational modules in the engineering curriculum and similar flipped learning approach was adopted in both classes such as the progress, the implementation, the physical setting, and the interface with Moodle-based resources.

Two study modes distinguish the two modules with different curriculum hours. Given the same qualifications framework level 3, ENG3012 has 45 hours including 25 hours of lecture, 15 hours of tutorial and 5 hours of laboratory, while CON3301 has 26 hours including 13 hours of lecture, 9 hours of tutorial and 4 hours of laboratory. Video lectures in English were available on Moodle platform and ENG3012 was considered as a control for gauging the discrepancies between both groups of students about flipped learning approach. A questionnaire survey was done in both classes to collect students' feedback, problems encountered, and the way forward.

There are five key questions to collect students' valuable views on the implementation of flipped learning approach. Key question 1 asks whether students watch the video lectures before the class or not. If students have watched the videos, the questionnaire asks whether the videos helpful for them to understand the topics in key question 2. If students have not watched the videos, the reasons of why they do not watch the videos are asked in key question 3. Key question 4 asks the students' opinions on the effectiveness of flipped learning approach than that of traditional lecture. Last key questions addresses what are the possible activities in the class session. The students' feedback is analyzed for the comparison of impacts on flipped learning approach towards students in different study modes. However academic result is not used as an indicator because of different learning contents. Minor changes will be made to ensure equivalence between other factors.

Results and Discussion

A big difference is found between part-time and full-time students on the actual preview rate of video lectures in a flipped learning approach. Almost no part-time students watched the video lectures while around three quarter of full-time students watched that. Key question 3 also shows the same situation in which part-time students considered there was no enough time to watch the video lectures, in contrast to full-time students who did not view the video lectures may be activated by modification of video lectures.

The results echo with previous research findings that level of commitment and motivation are two important factors that drive the effectiveness of flipped learning approaches. Among these two factors, level of commitment was more applicable to part-time students and motivation was more applicable to full-time students in this survey. For all students who watched the video lectures, majority of them agreed that the video lectures were helpful in understanding the topics.

Comparing traditional lectures, both classes agreed the flipped learning approaches were more effective while full-time class yielded a clear result. If flipped learning approaches were adopted, most of the students would prefer to have game-based activities in its place. Small-group and large-group discussion were second and third preferable options in their point of views. The summary of results is tabulated in Table 1.

The move from a traditional lecture to presenting that same lecture online is unlikely to result in learning differences if nothing else changes. Comparing full-time students, part-time students have more difficulties in finding time to watch video lectures because of their works. In this study, although part-time students also recognize the benefits and effectiveness of flipped learning approaches such as manipulating the pace of learning by pausing, rewinding, fast forwarding or skipping any parts of lecture videos, the constraint of tight study schedule is the largest hurdle in applying flipped learning approaches for part-time students.

The information-transmission component of a traditional lecture is moved out of class time if possible and replaced by a range of interactive activities designed to entice active learning. However, in most cases, engineering subjects are not solely information-transmission but require deeper understanding of concepts and skilfully practice of calculation. Unless a lecture has the sole goal of transmitting information, flipped learning is probably not the best approach (Bligh, 2000). Further researches should be done in order to identify the content to be delivered.

A Call For Further Research

There are many factors that play key roles in the effective use of flipped learning approaches. Only time and further researches will tell if flipped learning approach yield predictable, repeatable increased performance. A limiting factor in this study was its small sample size of 48 participants. A larger sample size and perhaps a same modules study would be

Table 1. Summary of survey results for both full-time and part-time classes.

	Full-time Class		**Part-time Class**	
Key Question 1. Have you watched the video lectures before the class?	**Yes**	**No**	**Yes**	**No**
	71.4%	28.6%	5%	95%
Key Question 2. If you have watched the video lectures, do you find it helpful in understanding the topics?	**Yes, it can.**	**No, it can't.**	**Yes, it can.**	**No, it can't.**
	80%	20%	100%	0%
Key Question 3. If you have not watched the video lectures, why?	**The video is in English and I don't understand**	**I forget**	**Too busy and I have no time to watch them**	**Others**
	75%	25%	84%	16%
Key Question 4. Comparing traditional lectures, do you find flipped learning approaches more effective?	**Yes**	**No**	**Yes**	**No**
	71.4%	28.6%	55%	45%
Key Question 5. If flipped learning approaches are adopted, what activities can make your learning more effective?	Small-group discussion: 14.3%; Large-group discussion: 7.1%; Game-based activities: 53.6%; All of the above: 14.3%; Others: 10.7%		Small-group discussion: 20%; Large-group discussion: 15%; Game-based activities: 40%; All of the above: 25%	

informative. A same modules survey would also be helpful to identify any disparities that are not affected by subject contents. In general, it is important to ensure teachers have the skills and pedagogical understanding required to embed constructively aligned active learning within the approach. In particular, future efforts will focus on how to modify the current flipped approaches to suit the needs of part-time students. Perhaps shorter videos will be used and incentives should be added to attract students to preview the videos.

Conclusions

Flipped learning approach are being adopted with much enthusiasm despite the paucity of specific evidence about their efficacy. In the absence of evidence of the efficacy of flipped classroom in general, the findings should encourage the practice of flipped learning approaches in the future, and support future research into exploring the adaptation and development of flipped classroom as an innovation educational pedagogy.

This paper outlines a study of the flipped learning approach with part-time and full-time engineering students at tertiary level education. The flipped classroom is a new pedagogical method, which employs video lectures, and interactive activities in the classroom. The results between part-time and full-time students are very different in some senses. Using full-time class as a control point, a survey was conducted in two engineering science courses at Hong Kong Institute of Vocational Education (Tuen Mun) during the spring semester of academic year 2015/2016. All students were asked to complete video lectures outside the classroom and full time students were considered as a gauge against part-time students. The two groups were compared using a same questionnaire addressing 5 key questions.

In conclusion, part-time students found it difficult in fitting flipped learning structure due to different level of commitment than that of full-time students. The biggest hurdles to achieve full effectiveness of flipped learning approaches for part-time and full-time students were busy work-study schedule and motivation respectively. Despite the difference in programme nature, both part-time and full-time students agreed that flipped learning approaches would have benefited their studies somewhat. If flipped learning approaches are adopted, game-based learning activities and small-group discussion should be in its place of the class session. Three implications should also be highlighted in this study during applying flipped learning approaches including 1) to move most information-transmission teaching out of class, 2) to use class time for learning activities that are active and social and 3) to adjust the length and language of video lectures whenever appropriate.

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