



## Efficacy of a Flipped-Classroom on Learning and Confidence of Engineering Students

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### ABSTRACT

A flipped classroom is a type of blended learning (BL) that students learn the materials at their own time and by attending at a physical classroom. This method helps learners to learn the materials at their own time and reinforce their learnings in a classroom. This study interrogates efficacy of a flipped-classroom in comparison with traditional teaching method on students learning and confidence in a geotechnical engineering unit at Curtin University, Perth Western Australia. To do so, an experimental investigation was performed on students enrolled in a semester-long geotechnical unit and they have options of flipped model or a conventional model classroom for their learning. To score students' performance against learning and confidence, a Likert scale was employed to rate students level of confidence by introducing a 20-items knowledge assessment on five topics before and after each learning. The results showed that students attended in a flipped-classroom gained higher scores in comparison with the students attended in conventional teaching course. For confidence rating, the traditional course students ranked a lower confidence than the flipped group for all assessed modules.

**Key Words:** Blended Learning; Flipped Classroom; Engineering Education; Geotechnical Engineering Unit

### 1. INTRODUCTION

Blended learning is a method of education that encompasses two main components of online learning and face to face classroom. Fig. 1 graphically shows the components of a blended learning.

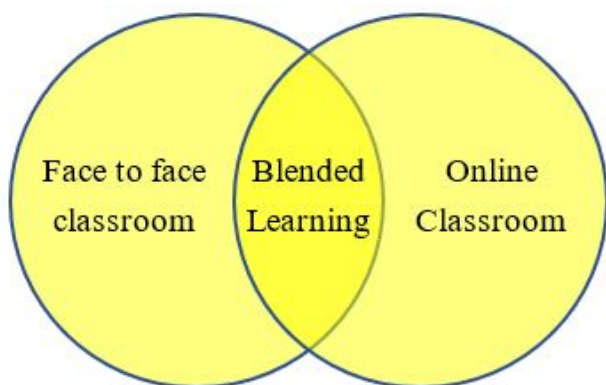
Flipped-classroom is an active teaching approach that promotes learner's contribution in teaching/learning processes. This is in a contrast with a traditional teaching

approach that learners have a passive role and they are only recipient of the new knowledge from a lecturer/instructor. It has been indicated that if a flipped classroom model strategically applied in a classroom, a good level of bloom's taxonomy is achievable [1]. In a flipped classroom, students are accountable to complete a series of tasks using an online learning platform and then to attend in a face to face classroom to ask their questions [1-3].

Sadik [4] investigated effectiveness of a flipped classroom on student's involvement and their satisfaction by means of survey. He indicated that students in a flipped classroom model showed a better behavioral and cognitive engagement with the lectures and their satisfaction improved [4].

In another example, Mason et al. [5] compared a flipped classroom with a traditional model of teaching for engineering students. They indicated that in a flipped classroom students' performance is similar or even better than the face to face classroom and lecturers have more time to cover more materials in this type of teaching. They also indicated, students had initially struggled with adapting with new type of teaching however, they get use to the new method of learning [5]. In another study, Unal and Unal [6] investigated effectiveness of a flipped approach on lecturer's satisfaction as well as students' performance and perception. They indicated that utilisation of an inverted model improves lecturer's satisfaction as well as student's perception and performance. They indicated that if a flipped style of teaching properly implemented, it can be a very effective method for student's satisfaction [6]. Similar results were reported in other literature [7-15].

A review of older researches showed that investigation performed mainly on efficacy of flipped classroom on student's satisfaction, engagement and perception, however, no studies conducted to interrogate efficiency of inverted-classroom on learners' knowledge and confidence on utilisation of their learning. In particular, this study is a unique investigation for engineering students.



**Figure 1:** Main components of a blended learning approach

## 2. MATERIALS AND METHODS

An experimental method was implemented to interrogate variations between a conventional classroom with a flipped-classroom approach. At the first stage, comparison conducted to investigate the prior knowledge and confidence on two participating groups by scoring a survey. Students learning experiences and their confidence in implementation of their learning were compared amongst two educational methods. Students enrolled in the geotechnical engineering unit had a freedom to opt a flipped-classroom or a conventional face-to-face classroom.

Confidence of the students in utilisation of their learning in real world projects is an important indicator of their learning. In this experiment, confidence of the students was ranked. Filling the questionnaires was not mandatory and students had a freedom to fill the form if they liked. In order to encourage students to fill the questioner, every effort done to keep that short and concise.

## 3. RESULTS

### 3.1. Demographics of Engineering Students

Table 1 shows the attributes of the students participated in the survey. As seen, 32 persons have attended in flipped course and 42 persons have attended in traditional course.

**Table 1:** Attributes of the students attended in the survey

	Flipped Course (Number= 32)	Traditional Course (Number= 42)
Feedback on the work	81	76

### 3.2. Knowledge Assessment Results

The results shows the results of pre-test and post-test knowledge assessment for attendees in flipped and traditional course. As seen from the pre-test knowledge assessment, both groups of students attended in flipped and traditional courses had an almost similar pre-test score. In fact, the pre-test score only shows the students prior knowledge with respected with their personal experience. A significant improvement can be seen in the post-test knowledge assessment scores. The students attended in flipped course had a mean value of 74% whereas students attended in traditional course had a 65% median value. As seen, students after attending flipped course achieved a better understanding about the geotechnical engineering subjects.

### 3.3. Confidence Results

The confidence results showed that students attended in flipped course has a higher confidence value to utilise their knowledge in comparison with the traditional for all geotechnical engineering topics. The students indicated as very confident are much higher than students mentioned less confident or not confident in flipped course. This outcome also was checked in research items and comprehension of students tested against some of those [16-23], the students feedback was encouraging and further supports flipped classroom usage. In writing of this report some of the ideas was taken from [24, 25].

## 4. DISCUSSION

The results showed that the students who attended in flipped class-room and attended both online and face-to-face classroom showed a better performance in comparison with the students who only attended in a face-to-face traditional course. This is in coincidence with the results reported by the literature in implementation of the flipped classroom. This enhanced students' knowledge and confidence in utilisation of their knowledge. Some issues have been reported by the students such as technological issues that interrupts in some stage students learning. The results of this study support the efficacy of flipped classroom for the purpose of teaching geotechnical engineering topics in lieu of a traditional teaching method. This should be noted that the results of this study to assess knowledge of the students only relied on multiple-choose questions in five geotechnical engineering topics.

## 5. CONCLUSION

Two method of flipped classroom and traditional classroom were analysed in this study and the results showed that the engineering students achieve a better knowledge and more confidence in utilization of their knowledge through a flipped classroom.

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