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# Some Experiences of Implementing the Concept of Flipped Classroom in the Field of Engineering

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## **ABSTRACT**

The new curriculum for schools in Finland urges the teachers to use different applications of modern technology in teaching. The aim of this is not only to enhance students' technical skills and provide them with skills needed in tomorrow's working world but also to find teaching methods which suit different types of learners.

This paper focuses on an instruction strategy and a method in the field of engineering known as called the Flipped classroom. Flipped classroom combines both the modern technology and contact teaching.

In this paper, we are going to give an in-depth knowledge about one of the new teaching method instruction strategy or a method, which employs the contemporary technology and interaction teaching. Traditionally the new things are taught during the lesson and then students practice the new skills as their homework. In Flipped classroom, students receive new information before the lesson for example, by watching a video. This way they have basic knowledge beforehand and contact teaching time is saved for problem-solving and personal support deepening their knowledge and skills.

This study about Flipped classroom is focusing on finding out the theoretical background of this method and on the empirical data gathered from one university of applied sciences. In addition, reflecting the author's own experiences from teaching in the frame of Flipped classroom.

## **BACKGROUND AND LITERATURE REVIEW**

In 2006, two Colorado high school teachers, Jonathan Bergman and Aaron Sams introduced screencast and podcast for their students even though they were not aware of the termed flipped classroom (Milman, 2012). Flipped classroom is known as a new pedagogical approach (inverted classroom) in which video lectures, screencast or podcast and problems are practiced as homework and those tasks that need to be solved in groups are done in classroom, but, both activities do not occur concurrently (Bishop & Verleger 2013; Bergman & Sams, 2012; Milman, 2012).

According to Bishop and Verleger (2013), most students still prefer one to one lectures to video lectures, yet students are interested in flexible learning rather than traditional lectures. However, their research suggests that student's learning outcome has improved after using the flipped classroom. Some educators believe that Millennial students find it difficult to concentrate on their studies that is why they want to shift to the flipped classroom. Millennial experts argued that students' desire and resilience has changed and therefore there is the need to adopt different teaching method to deal with the situation (Roehl, Reddy & Shannon, 2013). An online learning using videos prior to contact lessons

encourages skills development, problem-solving and gaining a deeper knowledge of subject matter. Students have the advantage of knowing the subject beforehand and, students can use their lectures hours for in-depth analysis of the subject (Smith, Sheppard, Johnson, & Johnson, 2005). Many studies view flipped classroom technology as a strategy best for teaching procedure knowledge but also useful for factual knowledge, conceptual knowledge and ones thinking mental processes knowledge (Pierce & Fox 2012; Milman, 2012).

To engage in flipped classroom concept there are several factors to be considered to achieve the ultimate goals in the learning processes and objectives. Gilboy, Heinerichs, & Pazzagli (2015) conducted a research about how to engage students in the flipped classroom to improve their learning. Their findings were that, firstly, students have to understand the concept of the flipped classroom, especially how and when to use this strategy which involves designers, education institutions, and teachers. Secondly, the students have to understand that they are solely responsible for completing their tasks before coming to class. However, their research results compared the performance of students who used traditional learning method to in-class learning method to ascertain the difference in performance of the students involved. (Gilboy, Heinerichs & Pazzaglia, 2015)

Similarly, Kong (2014) conducted a research on the flipped classroom, his work focuses on the outcomes of student's performance and using traditional classroom. He argued that flipped classroom is useful for more motivated students. The research learning outcome of flipped classroom as new pedagogy is not suitable for all subjects.

When the implementation of Flipped classroom grows, further investigation of the new approach of teaching and learning is needed to achieve the full benefits of the flipped classroom (Abeysekera & Dawson, 2015). As the term implies, the technological approach of teaching using video can also be a treat to students. However, teachers and students must be familiar with technology before they can apply flipped classroom in their learning and teaching process, for example, an access to the internet might be a big challenge. (Moran & Milsom 2015; Mason, Shuman & Cook, 2013). Comparing the effectiveness of an inverted or flipped classroom to a traditional classroom in an upper-division engineering course (Mason, Shuman & Cook, 2013). Herreid, & Schiller (2013) also argued about the content on the part of teachers to fulfill as national requirement which makes the flipped unsuitable to use rather than the traditional way of teaching.

## **EMPIRICAL STUDY METHODS**

The purpose of this research was to investigate how flipped classroom has influenced learning. The Flipped classroom was implemented at one university of applied sciences where first-year Bachelor's Degree students from the field of Mechanical engineering and Production Technology used the Flipped classroom in their Mechanical Drawing and CAD course. In all 35 students were engaged. Figure 1, gives schematics view of the approaches and methods used to conduct this research.

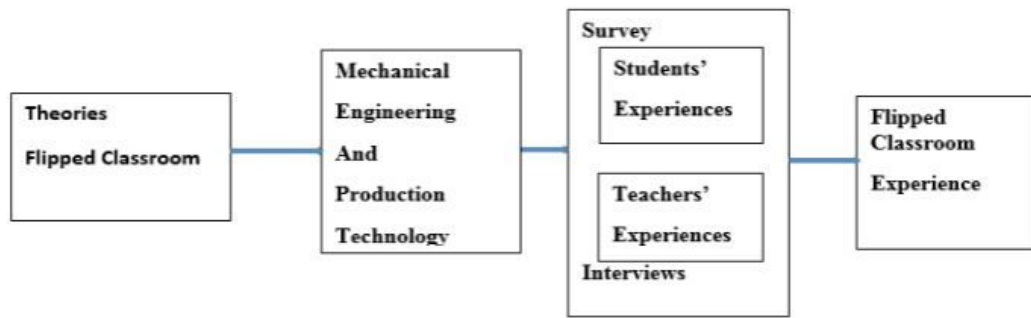


Figure 1: The Schematic diagram of the study.

As shown in Figure 1, the study adopts different strategies, the first method, was to use the database to investigate the background of the flipped classroom, including previous studies about the flipped classroom. 35 students who volunteered in the study, answered to the survey according their own understanding and experiences about the flipped classroom. In addition, five teachers were interviewed based on semi-structured interview method. The survey and interviews focused on the experiences and opinions about Flipped classroom as a teaching and as a learning method.

The study used the quantitative method to analyse the survey data and the interviews. For example, like-type scale: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree were used to ask for students opinions on question such as:

- I would like to participate in more courses that use video lectures alongside traditional classroom learning.
- The video lecture(s) were easy to access.
- The video lecture(s) helped me learn.
- Discussing with classmates helps me learn.
- Compared to other lessons / courses I've taken this lesson / course is interactive.

Teachers and students answered the survey with clarity which provided consistent data that was easy to analyze using Microsoft Excel. The research analysis the flipped classroom uses in terms of student and teacher opinions.

#### Demographics of participants

The students were between the ages of 17 to 25 years, of which 26 of them were male and the remaining 9 were female. The students were international representing five 5 different countries.

### Students' Perspective

According to the statistics from Figure 2 and 3, five of the students(14%) from the group have no idea about flipped classroom teaching and learning approach. The students who have no idea believed that their ignorance of the using the flipped classroom is as a result of their country of origin, where they had their previous education, especially those students from Kenya and Nepal. The students from Nepal were of the view that access to internet is very expensive and as new students in Finland they are hoping to bridge that gap between them and their European counterparts who have more internet access

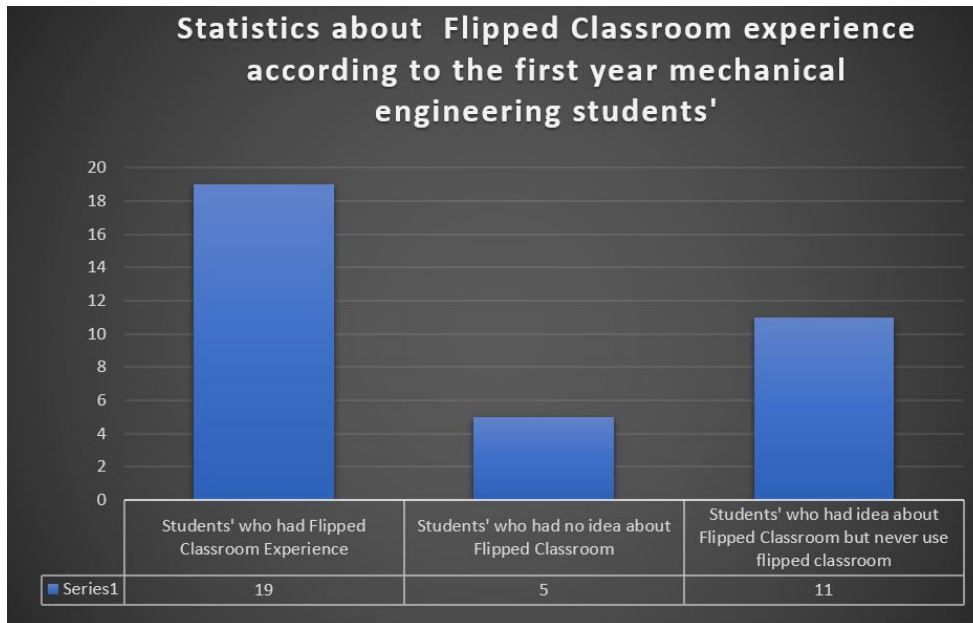


Figure 2 :Statistics about Flipped Classroom experience according to the first year Mechanical students.

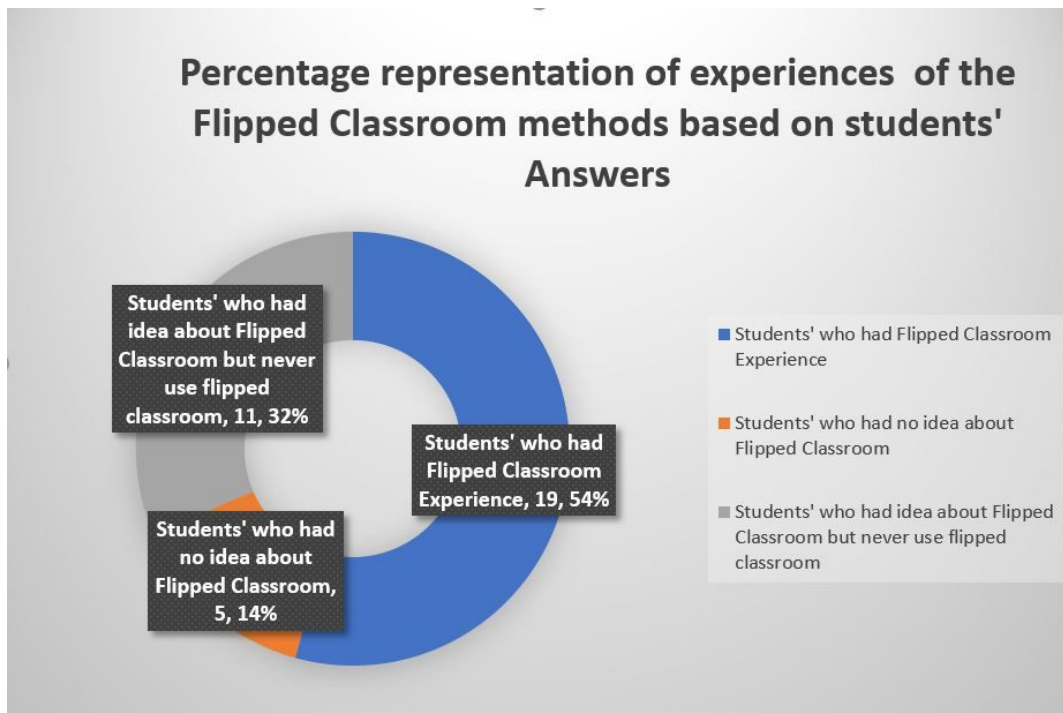


Figure 3: Percentage representation of Flipped Classroom Experience.

Figure 3 also indicate that 54% of the students have used flipped classroom. Even though these students are familiar with flipped classroom as a new learning approach, they are of

the view that flipped classroom has influenced their studies positively. However, they noted that the poor quality of the videos can also be a disadvantage for learning.

### Teachers' Perspective

Five teachers' from the field of Mechanical engineering were interviewed. Figure 4 shows clearly that all the teachers are familiar with Flipped Classroom, and there is an increasing trend of flipped classroom usage due to use of advanced in technology.

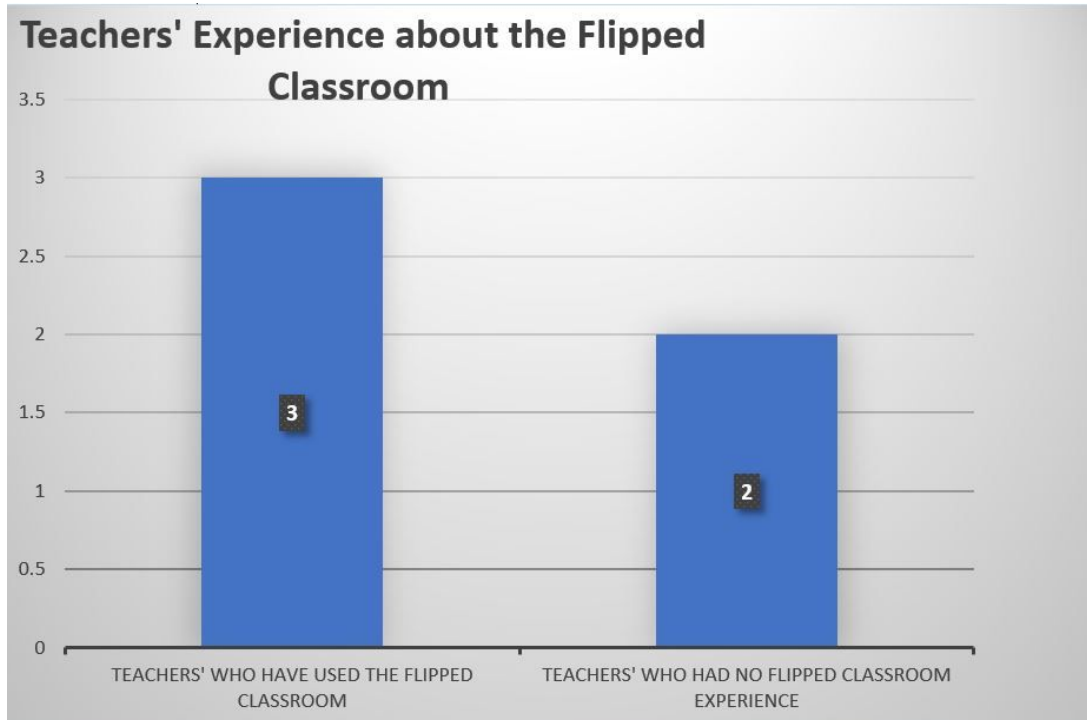


Figure 4: Teachers' experiences about the Flipped Classroom

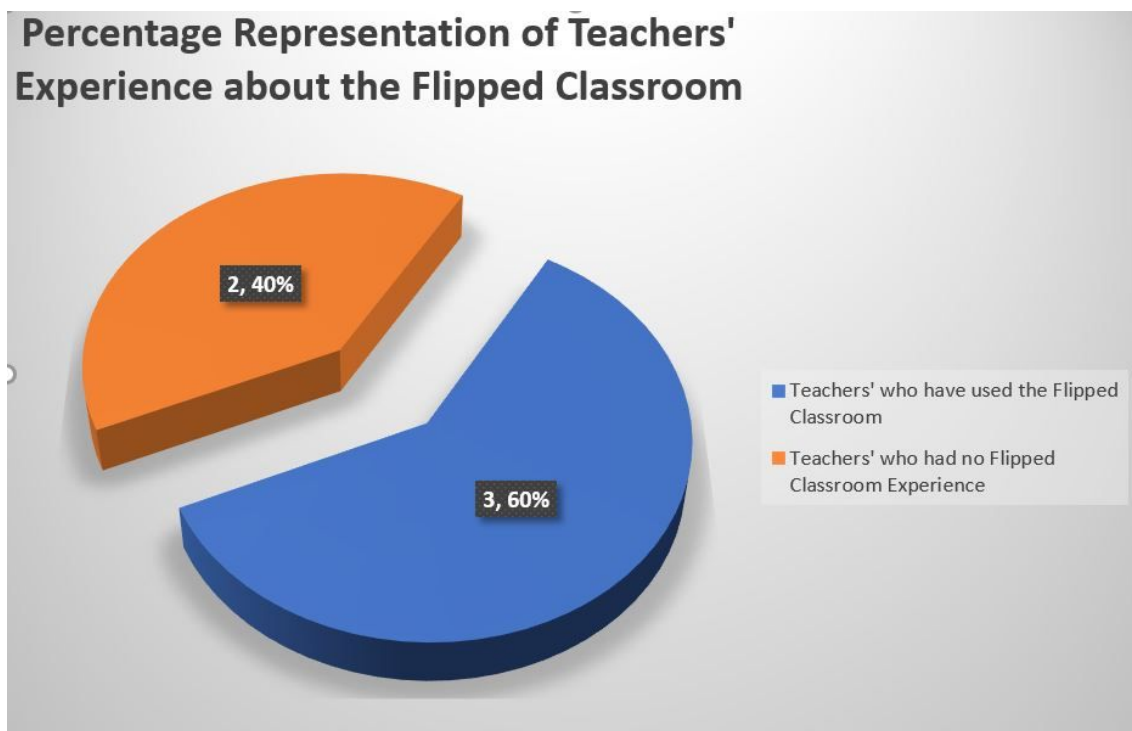


Figure 5: Percentage representation of teachers' experience about the Flipped Classroom

## CONCLUSIONS

The flipped classrooms have become more popular in recent years as the brief review of the literature indicated. The method is well-suited to an independent and ubiquitous learning, in which students and teachers can learn and teach respectively from their homes, bus stations, and many places without necessarily being in the classroom.

This study looks at how the flipped classroom has influenced studies especially in the field of mechanical. This study about the flipped classroom is focusing on finding out the theoretical background of this method and on the empirical data gathered from one university of applied sciences. In addition, reflecting the author's own experiences from teaching in the frame of the flipped classroom.

The flipped classroom has been the basis of distance learning nowadays, a situation whereby students and teachers can learn and teach respectively from their homes, bus stations, and many places without necessarily being in the classroom. In this case, technological tools such as computers, cameras for recordings and internet which are very necessary are needed to facilitate the learning process. However, it is also important that classroom meetings are required to solve technical questions and cumbersome topics, which are not properly addressed by teachers during the flipping.

Perhaps, our deductions from this research were based on the various teachers' as well as students' personal opinions about the flipped classroom in the University Applied Sciences where this research was conducted. Based on the students' survey and teachers interviews, the following summaries can be made:

- Once a lecture is video recorded, it can be reused as many times as the teacher wants
- It is easier for students to deal with their assignment when applying the flipped classroom
- The time spent in the classroom enables students to get a deeper understanding of the topic since they have pre-knowledge by watching the videos at home
- The flipped classroom concept encourages adult students as traditional classroom learning does not favour to work from their homes. The technology aspect also encourages students to learn
- However, some teachers think that their workload increased

It seems evident, based on these empirical findings from students' and teachers' experiences that the flipped classroom was a successful method in supporting learning in the field of mechanical engineering, especially in teaching and learning engineering drawing. Perhaps the extra time is required to learn a new teaching method, it would eventually be paid back and workload decreased when high quality videos can be used many times.

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