Chapter 2

To Flip or Not to Flip?
A Case Study on University Engineering Students

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ABSTRACT
The use of flipped classroom in higher education has increased in recent years, but there are still few quantitative data on student achievement. In this chapter, a flipped classroom methodology has been applied during two consecutive academic years in an engineering degree. During the first year, one group was taught with traditional lecture (used as contrast group) while the other used the flipped classroom. In the second year, both groups were taught with the flipped methodology. The main objectives were to measure the impact of learning focusing on possible gender differences and on active students to increase the students’ involvement and to study how the students view this new experience. The results show that the developed methodology has a direct impact on learning improving the final grades and decreasing their dispersion. The students tend to attend more to class and to exams with this methodology.
INTRODUCTION

In the traditional teaching model, information primarily passes from the instructor to the students that usually do not interact with the instructor or with each other. In best cases, teachers use class exercises that require students to be actively engaged in the course material, as opposed to being passive recipients of information. While some researchers demonstrate that increasing the student involvement will enhance its performance, some others may be still reluctant to use instructional methods that require students to engage in active or constructive learning in their courses (Velegol et al., 2015). Based on the Confucian idea Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand several techniques appear to improve students learning in the traditional classroom. Since the year 2000, due to the incorporation of computers into our daily activities, a change in teaching methodology has occurred involving the student as an active member in their learning process.

In the flipped classroom methodology (Baker, 2000; Lage et al., 2000), also known as flipped learning or flip teaching, the activities traditionally done in and out of class are flipped or inverted. Instead of just listening the lecture in class, students are required to do different preparatory work prior each class. Then, class time can be dedicated to complete active, constructive, or interactive activities. With this methodology, the receptive phases are developed by the students at home, whilst the reactive ones are cultivated with the work in class (Bloom et al., 1956). Also, with this methodology, the teacher-student interaction and roles are modified. The interaction between student-teacher and student-student increases during class time; in addition, the teacher is now the driver and guide of student learning to complete the in-class activities, providing assistance as needed.

This chapter reports on a case study of the flipped-classroom model. The method is implemented on a large obligatory subject of a second-year students called “Heat and Mass transfer”. This course evolved from a lecture-based course to a flipped one, based on the idea presented by Fidalgo-Blanco et al. (2017a) called Micro flip teaching. The results presented here were obtained during the course 2016-17 with one group using the flipped classroom methodology while the other remained with the traditional method. Also results of the course 2017-18 are presented with both groups employing the new methodology.

Background

It has been demonstrated that students’ learning increases as the required activities shift from passive to active focusing in the students’ role, autonomy, self-regulation and engagement (Burke & Fedorek, 2017; Chi, 2009). The flipped classroom is an important step in this direction, although there is no uniformity in its application or in the techniques to be used (O’Flaherty & Phillips, 2015). There is a general idea of the elements that a flipped classroom should have while it is difficult to find two identical applications. The students improve the basic knowledge mainly through online resources such as video lessons, assessments, reading notes, or by using online tutoring system (Berrett, 2012; Strayer, 2012); which ensure their preparation to the in-class activities. These in-class activities may include brainstorming, discussions, problem solving, invited talks, field works, among others. In engineering courses, problem solving is probably the most common application (Velegol et al., 2015). As some authors suggest (Hao, 2016; Karabulut-Ilgu et al., 2018), there is a clear need of studies objectively measuring the impact of flipped approach on student grades in different learning scenarios.
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