Effects of Learning Analytics on Students’ Self-Regulated Learning in Flipped Classroom

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ABSTRACT

The present article is aimed at analyzing the effects of learning analytics on students’ self-regulated learning in a flipped classroom. An experiment was conducted with 96 engineering students, enrolled in a subject offered in the Flipped Classroom model. The students were divided into two groups: an experimental group (N = 51) and a control group (N = 45). After each learning unit, while the control group did not have access to any learning analytics resources, students from the experimental group received a bulletin with feedback to support Self-Regulated Learning. The levels of student self-regulation were measured through questionnaires at the beginning and the end of the course. The analysis of the collected data revealed that the bulletin promoted significant effects in self-regulated learning in the experimental group, stimulating the self-reflection and colleague’s support search for clarifying doubts. These results demonstrate that learning analytics can be used to promote self-regulated learning in flipped classrooms, helping students identify strategies that can increase their academic performance.

KEYWORDS

Active Learning, Blended Learning, Flipped Classroom, Higher Education, Learning Analytics, Learning Strategy, Learning Systems, Self-Regulation, Students, Teaching

INTRODUCTION

One of the most frequent definitions regarding Flipped Classroom (FC) is “…school work at home and homework at school…” (Yarbro et al., 2014). This definition is similar to that proposed by Lage et al. (2000), who described FC as the reversal of events that traditionally used to occur within the classroom and started to happen outside the classroom and vice versa. Despite justifying the use of the word “flipped”, these two definitions are simple and do not reflect important features of this educational model thus FC has been defined by other perspectives in recent works. These perspectives...
observe the connections among learning theories, attributions of the involved actors (teachers and students) and the purposes of face-to-face and distance-learning activities.

According to Bishop and Verleger (2013), this model combines theories that were considered incompatible with activities associated with active learning, based on a constructivist ideology, and with direct instruction methods, that derived from behaviorist principles. In FC, the main role of the teacher is to mediate the learning process instead of concentrating on the content presentation, while the student is responsible for previous preparation and involvement during the lessons (Valente, 2014). Fidalgo-Blanco et al. (2017) and Mazur (2013) define the FC as a specific model of Blended Learning (Zhonggen, 2016), in which distance-learning activities aim to transmit knowledge before face-to-face sessions and class time is for content assimilation.

FC studies reveal that the educational outcomes of this model may be more promising than the traditional teaching process (Bishop & Verleger, 2013). On the other hand, a critical point in the vulnerability of this model is the great dependence on the knowledge acquired by students in distance-learning activities (Sun et al., 2016). The problems experienced in these activities negatively affect student’s participation in face-to-face sessions, which increases the probability of failure in the inverted learning (Karaoglan et al., 2017).

Different from the face-to-face sessions, in which the teacher can exert an expressive control of the learning process, the student must have a high level of Self-Regulated Learning (SRL) skills in the distance-learning activities. These skills involve proactive actions from the student to achieve learning goals such as setting aims, self-monitoring, time management, and effort regulation (Zimmerman, 2000).

Studies point out SRL as an important factor to increase students’ performance in distance-learning activities and in FC (Rodrigues et al., 2016; Sun et al., 2016). While there is a recognition of SRL role, researches on how to help students to develop this type of skill in the context of inverted learning are still incipient. As the adoption of FC increases in educational institutions, investigating mechanisms to promote student self-regulation in this educational model has become increasingly relevant. Learning Analytics (LA) is an emerging field of Educational Technology that can collaborate with this type of research, through pedagogical feedbacks elaborated from data collection of the student and the learning environment (Fidalgo-Blanco et al. 2016).

According to Durall and Gros (2014), LA offers potential solutions to assist students in SRL processes. Some papers have presented empirical evidence of these potential solutions (Corrin & Barba, 2015, Tabuenca et al., 2015, Davis et al., 2016). However, no studies were found in the literature with the evaluation of this potential in FC scenarios. Due to this lack of studies, the purpose of this study was to analyze the effects of Learning Analytics on students’ Self-Regulated Learning in Flipped Classroom.

A controlled experiment was conducted in the Mechanics of Materials subject, which was offered in the FC model for engineering students of a public university in Brazil, in order to reach the established objective in this study. The choice of this subject was motivated by its presence in most Engineering courses, which increases the number of researchers and institutions that can benefit from the results of this work. Besides this introduction, this article is organized into four more sections which present the theoretical foundations, the method used, the discussion of results and the final considerations.

THEORETICAL FOUNDATIONS

Benefits and Challenges of Flipped Classroom (FC)

The first reports of FC experiments were published about two decades ago (Mazur, 1997; Novak et al., 1999; Lage et al., 2000). However, this model has not been widely disseminated for years as result of technological limitations that made it difficult to produce and distribute instructional materials. As
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