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An Investigation Of Student Web Activity In A "Flipped" Introductory Physics Class

Taha Mzoughi[a]*

[a]*Kennesaw State University, 1000 Chastain Rd., #1202, Kennesaw, GA 30144-5591, USA*

Abstract

In the last few years, flipped teaching has become one of the most popular teaching trends being adopted. Yet, there is a lack of data on what students use and find useful while taking these classes. This paper focuses on the use of class web logs, student surveys and class records to analyze student use of the material developed as well as how this use correlates with course results. The course being investigated is taught once a year by the same professor. It is the second course in an introductory physics course sequence for life science majors. The flipped format was adopted gradually in the course starting the Spring 2009 semester. The analysis focuses on the last iteration. The current format of the course was partially driven by student input, and took several years to fully implement. In this case, lecture time is devoted to answer and discuss questions, work on practice problems, and, sometimes, to explore the topics students find interesting. Instead of lectures students complete online multimedia quizzes, embedding both short lecture type recording segments simulations and videos. The quiz format is meant to help students identify the topics they don't understand. Homework is also completed online. It includes both traditional end of the chapter problems and simulation mediated questions. Students also complete pre-laboratory simulation mediated activities. The analysis focused on the analysis of each of the components the students complete online. That data was also correlated to the student performance in various class assignments.

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Keywords: flipped; inverted; reversed; classroom; teaching; web-enhanced; hybrid; blended; active; passive; online; lecture; recordings; video

* Taha Mzoughi. Tel.: +1-678-797-2152; fax: +1-770-302-4202.
E-mail address: tmzoughi@kennesaw.edu

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1. Introduction

There has been considerable interest in the last few years in what is termed "the flipped or inverted classroom" (Alvarez, 2011; Bergmann, 2012; Bishop, & Verleger, 2013; Herreid, & Schiller, 2013; Rundquist, 2012; Tucker, 2012.). The flipped classroom being a form of blended learning where attempts are made to make class time more of an active environment. This is usually done by combining online delivery of course content with various forms of active engagement activities during lecture time (Bishop, et al., 2013; Hamdan, et al., 2013). The content delivered online varies from professionally prepared video content (Chen, et al., 2010; Sadaghiani, 2011), to compilations of freely available YouTube videos (Riendeau, 2012 ; 2013), and screencast recordings done by the instructors videos (Christensen, W., 2013). The in-class activities also vary (Bishop, et al., 2013; Hamdan, et al., 2013). With the increased interest in this method of teaching, there is interest in research focusing on its overall effectiveness as well as the effectiveness of the various methods and tools used in implementing it. Amazingly, there are several Master Theses (Glynn, 2013; Snowden, 2012; Zownorega, 2013). and at least one PhD theses (Strayer, 2007) that were already completed and focusing on Flipped Teaching. There is also a wealth of articles focusing on both the concept of "Flipped Learning" and on research focusing on "Flipped Learning" (Bishop, et al., 2013; Hamdan, et al., 2013.) In particular, there are a few studies focusing on using this method for teaching physics (Bates, et al., 2012; Deslauriers, et al., 2011; Zownorega, 2013). Yet, the results are mixed and they don't provide a complete picture on the dynamics of a"Flipped Classroom". This paper, attempts to add to the knowledge gained by these studies by analyzing students access logs as well as student answers to survey questions in an introductory physics class.

2. Research Design

2.1. Setting

Kennesaw State University (KSU) is a suburban school just northwest of Atlanta, Georgia with a total student enrollment of about 25,000 students. The course is the second of a two semester introductory algebra-based physics course for science majors. 75% of the students who took the course were biology majors, the rest were mainly computer science and exercise science majors. 58% of the students are females. Unfortunately, 85% of the students taken this introductory class have reported themselves as "seniors". This tardiness is usually due to combination of factors including the limited offerings of course sections as well as a student "fear of physics". When asked about their interest in taking the course, only 34% indicated any interest. Classes met twice a week for a 75 min lecture and once a week for a 165 min laboratory session. Enrollment in the lecture was capped at 72 and in the lab at 24. Only 65 students have finished all course requirements. The professor taught lecture and one lab section. The other lab sections were taught by a graduate teaching assistant. Two undergraduate Learning Assistants (LAs) helped the professor during lecture (Goertzen et al., 2011).

2.2. Course Details

The course follows of a combination of what is termed as "web-enhanced" format to a "flipped teaching" format. The online tools used for the course were locally developed by the author (Mzoughi, 2000; 2003) and hosted locally at a server on campus. Like for typical course management systems, the tools permit the teacher to manage a dedicated course web page. The course page includes a calendar of classroom activities, links to the course syllabus and to previous test solutions, links to related simulations, as well as links to course related activities. These include forums, pre-lecture quizzes, and an online homework delivery system. Students were instructed on the use of the course web page during the first day of class. Furthermore, videos explaining the use of each of the web components of the course are prominently available at the course web page. Instead of lectures, short concept recordings (CRs) were made available online for all course content. Students were expected to view the CRs before coming to class. The length of the CRs varied from 57 seconds to 29:33 minutes, with a mean of 10:09 minutes (SD=5:50 minutes). A required guiding lecture quiz (GQ) was provided to help students navigate through the CRs. GQ questions were mainly multiple choice. Students were not penalized for multiple submissions. Students were also asked to routinely complete an online form listing the concepts that they have learned and the concepts they still find difficult. The