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# Currents in Pharmacy Teaching and Learning

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## Research Article

# Student use of flipped classroom videos in a therapeutics course



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## ARTICLE INFO

### Keywords:

Flipped classroom  
Therapeutics  
Student preparation

## ABSTRACT

**Purpose:** To evaluate the extent of student use of flipped classroom videos.

**Methods:** This was a cross-sectional study conducted in a college of pharmacy therapeutics course in the United States. In one section of the course (four sessions) all content was provided in the form of lecture videos that students had to watch prior to class. Class time was spent discussing patient cases. For half of the sessions, there was an electronic quiz due prior to class. The outcome measure was video view time in minutes. Adequate video view time was defined as viewing  $\geq 75\%$  of total video duration. Video view time was compared with or without quizzes using the Wilcoxon signed-rank test.

**Results:** There were 100 students in the class and all were included in the study. Overall, 74 students had adequate video view time prior to session 1, which decreased to 53 students for session 2, 53 students for session 3, and 36 students for session 4. Median video view time was greater when a quiz was required [80 minutes (IQR: 38–114) versus 69 minutes (IQR: 3–105),  $p < 0.001$ ]. The mean score on the exam was  $84 \pm 8$  points (out of 100). There was a significant association between video view time (per 50% increment) and score on the exam (coefficient 2.52; 95% CI: 0.79–4.26;  $p = 0.005$ ; model  $R^2 = 7.8\%$ ).

**Conclusion:** Student preparation prior to the flipped classroom is low and decreases with time. Preparation is higher when there is a quiz required.

## Introduction

Teaching methods in higher education are evolving to include active learning that incorporates student interaction and problem solving. Active learning has been shown to be more effective than traditional lecture in terms of student performance.<sup>1</sup> The use of the “flipped” classroom is one method that can be used to create time for active learning, and the method is gaining momentum in both K-12 and higher education.<sup>2</sup> In health sciences education, the flipped classroom has been shown to be more conducive to learning than traditional methods and is increasingly being incorporated into courses.<sup>3</sup> Flipping involves preparation by students ahead of time so that class time can be spent on interactive exercises. Content is first provided to students in the form of video or audio lectures or readings. The students are to review this material ahead of class time so that the time spent with the instructor can be optimized to focus on content application. Effectiveness of this “flipped” classroom requires students to prepare adequately prior to class. Literature regarding the extent of student preparation prior to the flipped classroom is limited, particularly in the health sciences literature.

In one college of pharmacy, an introductory pharmaceuticals course was modified from traditional lecture to the flipped classroom.<sup>4</sup> Faculty created video lectures for each class session, and class time was used for interactive activities. In general, the

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<http://dx.doi.org/10.1016/j.cptl.2016.08.043>

students considered this method more effective for learning, and students rated the course significantly higher ( $p < 0.05$ ) on an end-of-course survey. However, the faculty time commitment required to prepare the course increased three-fold, and managing the class required an additional 20 hours per week of teaching assistant time annually. The new approach only resulted in a 2.5% increase in exam scores. Unfortunately, the proportion of students that viewed the videos and prepared prior to class was not reported.

The primary objective of this study was to determine the extent to which students viewed prepared lecture videos before class after a flipped classroom format was instituted. The secondary objectives were to determine if student viewing of videos was higher with the use of quizzes on the material and if lecture video viewing prior to class was associated with quiz and exam scores.

## Methods

### *Study design and setting*

This was a cross-sectional study conducted at the University of Arizona College of Pharmacy. The study was determined to be exempt by the Institutional Review Board.

### *Subjects*

The study included all students ( $n = 100$ ) enrolled in a six-credit-hour therapeutics course. The course was offered to students in the second year of the professional program.

### *Intervention*

The flipped classroom format was used for the first module of the therapeutics course, which covered critical care therapeutics over four two-hour class sessions. Lecture content was pre-recorded in short videos and made available to students via the course website using Desire2Learn course management software. Students were able to view the videos asynchronously 24 hours per day. The lecture videos were created using Explain Everything™ (Version 2.60) Interactive Whiteboard software on an iPad (Apple, Inc.) by the course coordinator. Lectures were divided into seven to ten video segments of approximately five minutes each. The videos were created using an upbeat tempo and were kept short in duration in hopes of achieving better student engagement. The videos contained content similar to what would have been provided during an in-class lecture of the same topics. Students were expected to view the lecture videos prior to attending class. No other preparation or reading materials were required. Class time was spent discussing patient cases so that students could apply content covered in the videos. Quality of participation in analysis of patient cases during class was not graded.

The two-hour flipped class sessions included session 1 (pain, agitation, and delirium); session 2 (sepsis); session 3 (cardiac dysrhythmias); and session 4 (advanced cardiac life support). Before sessions 1 and 3, students were required complete an online open book quiz before arriving to class (ten points each). The students were notified of quiz dates at the start of the course and were told that the quiz questions were based on the lecture videos. The quizzes were open book so that students would have access to the videos in order to clarify concepts while they were taking the quiz. There was no required quiz prior to sessions 2 and 4. At the end of the module, a multiple choice closed book exam was administered to the students (100 points total). The flow of the module in this course is depicted in the [Figure](#).

### *Data collection and measures*

Video viewing times by student, quiz scores, and exam score were collected. The course website automatically maintains video viewing statistics for each student that can be accessed by the course coordinator. Video viewing statistics were downloaded prior to each class session to determine the view time for each student. Percent lecture video view time (defined as time online divided by total length of video) of  $\geq 75\%$  was considered to be adequate viewing. Quizzes were automatically graded by the D2L course management software. The exam was taken in-class by the students on Scantron® forms and graded by the college's grading machine.

### *Data analyses*

The primary outcome of interest was the number of students with a lecture video view time percent of  $\geq 75\%$ . Though there is no well-accepted breakpoint for this measurement, the upper quartile was selected and considered to be a reasonable breakpoint.<sup>5</sup> View-time percentage was gathered for each of the four in-class sessions as a dichotomous variable and reported descriptively. The secondary objective was to compare video view time between quiz and no quiz sessions. Thus video view time was also totaled for sessions 1 and 3 (quiz required) and sessions 2 and 4 (no quiz required). Median video view time was compared between the quiz and no quiz periods using the Wilcoxon signed-rank test. Video view time for the quiz and no quiz periods were standardized to 100 minutes each to enable comparisons of medians.

Another objective was to evaluate if video view time was associated with improved student performance as defined by quiz scores and exam score. The association between video view time and quiz score was evaluated using logistic regression analyses. The quizzes were dichotomized as full points versus less than full points. A linear regression analysis was used to evaluate the relationship between total video view time and exam score. The coefficient was reported per 50% increment in view time. An  $\alpha = 0.05$

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