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Experiences in Teaching and Learning

Use of condensed videos in a flipped classroom for pharmaceutical calculations: Student perceptions and academic performance[☆]Mark W. Gloudeman^{a,*}, Bijal Shah-Manek^b, Terri H. Wong^c, Christina Vo^a, Eric J. Ip^d^a Touro University California College of Pharmacy, 1310 Club Drive, Vallejo, CA 94592, United States^b Touro University California College of Pharmacy, United States^c Touro University California College of Pharmacy, Administration & Faculty 2, Rm. 109, 1310 Club Drive Vallejo, CA 94592, United States^d Touro University California College of Pharmacy, Administration & Faculty 2, Rm. 203, 1310 Club Drive Vallejo, CA 94592, United States

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ABSTRACT

Background and purpose: The flipped teaching method was implemented through a series of multiple condensed videos for pharmaceutical calculations with student perceptions and academic performance assessed post-intervention.

Educational activity and setting: Student perceptions from the intervention group were assessed via an online survey. Pharmaceutical exam scores of the intervention group were compared to the control group. The intervention group spent a greater amount of class time on active learning.

Findings: The majority of students (68.2%) thought that the flipped teaching method was more effective to learn pharmaceutical calculations than the traditional method. The mean exam scores of the intervention group were not significantly different than the control group ($80.5 \pm 15.8\%$ vs $77.8 \pm 16.8\%$; $p = 0.253$).

Discussion: Previous studies on the flipped teaching method have shown mixed results in regards to student perceptions and exam scores, where either student satisfaction increased or exam scores improved, but rarely both.

Summary: The flipped teaching method was rated favorably by a majority of students. The flipped teaching method resulted in similar outcomes in pharmaceutical calculations exam scores, and it appears to be an acceptable and effective option to deliver pharmaceutical calculations in a Doctor of Pharmacy program.

Background and purpose

According to the Accreditation Council for Pharmacy Education (ACPE) Standards 2016¹ Key Element 10.12, the didactic curriculum should be “delivered via teaching and learning methods that: (1) facilitate achievement of learning outcomes, (2) actively engage learners, (3) promote student responsibility for self-directed learning, (4) foster collaborative learning, and (5) are appropriate for the student population (i.e., campus-based vs. distance-based).” At Touro University California College of Pharmacy (TUCOP), active learning continues to be integrated into the pharmacy curriculum and certain didactic topics are delivered in the flipped format to further increase active learning.² In a typical non-flipped lecture, TUCOP students would spend approximately half their time taking part in a “traditional” didactic learning environment where the professor lectures on a topic, with the second half of

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* Corresponding author.

E-mail addresses: mark.gloudeman@tu.edu (M.W. Gloudeman), bijal.shah@tu.edu (B. Shah-Manek), terri.wong@tu.edu (T.H. Wong), christina.vo@tu.edu (C. Vo), eric.ip@tu.edu (E.J. Ip).

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the class time incorporating the use of Small Group Discussion sections involving case-based problems and activities.

Several pharmacy schools have also incorporated the flipped teaching method in their curriculum. For example, Wong et al.² reported using pre-recorded lectures in teaching cardiac arrhythmias for the basic science, pharmaceuticals, and therapeutics courses. Pierce and Fox³ utilized four one-hour pre-recorded lectures on renal therapeutics. McLaughlin et al.^{4,5} utilized 25 condensed lectures, each 35 min in length, to present material in a pharmaceuticals course. Recently, Cotta et al.⁶ reported on the use of the flipped in a course on pharmaceutical calculations using pre-recorded lectures of 40–60 min in length, demonstrating improved student performance and satisfaction. While the flipped teaching method has been shown to improve academic performance in some instances, student perceptions have been mixed.^{1,2,6,7} Recently, interest has been growing in using “TED (Technology, Entertainment and Design, LLC) Talks” type presentations typically limited to under 18 min in length as an effective means of disseminating information. TED Talks have become a popular means of disseminating information in short, targeted videos.⁸ In the current study, basic pharmaceutical calculations were delivered in three class periods using the flipped teaching method in a manner similar to the TED Talks format with multiple videos of 7–15 min in length. Learning advanced mathematics can be a challenge for some students, often requiring a high degree of structure and repetition. In fact, according to DC Geary,⁹ “for most people the mastery of secondary quantitative abilities appears to require highly organized, focused, and repetitive instructional practices.” Today’s students tend to avoid reading long texts and learn better from material presented on short segments. According to Twenge,¹⁰ “...when they must hear a lecture, these students respond to pictures, graphics and short video segments like those found on YouTube.” Increasing student acceptance of active learning can help overcome barriers to acceptance of active learning strategies.¹¹ The flipped teaching method has been used successfully in a drug literature evaluation course using short videos.¹²

In order to incorporate more active learning during the class period, the flipped teaching method using TED Talks format videos was implemented for first year pharmacy students on the topic of pharmaceutical calculations. The topic of pharmaceutical calculations was chosen for the current study for multiple reasons. The mathematics involved remain relatively constant over time, and would likely require minimal revision from year to year. Also, students who struggle with math would be able to review the recorded material repeatedly at their own pace if needed. The flipped method was initially implemented in an arrhythmias series a few years prior with positive results.² The topic of arrhythmias was chosen because it has been a challenging topic for students within our institution. This was the impetus for trying the flipped method for pharmaceutical calculations. In the study’s flipped teaching method, lecture material that previously would have been presented in the classroom was recorded prior to the class period. Various media were used as learning methods, including audiovisual recordings, reading assignments, and practice problems. The majority of the class period was then used to apply the material through group participation in activities such as problem solving exercises and small group discussion.

This study had two objectives: (1) determine the effectiveness of the flipped teaching method on learning pharmaceutical calculations by comparing the exam scores of students receiving the flipped teaching method (Spring 2015) to exam scores of students receiving the traditional teaching method (Spring 2014), and (2) determine the student perceptions of the flipped teaching method via survey.

Educational activity and setting

The pharmaceutical calculations series consists of three class periods, spaced out over a period of six weeks. This study utilized the existing course structure that had been previously built into the schedule. This structure was used for both the intervention and control groups. All three classes in both groups were taught by the same faculty member. The calculations were primarily algebraic in nature. Some calculations were more complex in their structure requiring multiple steps. The outline of topics is listed in Table 1.

In the flipped group, students were instructed to view five pre-recorded video modules before each class (each video

Table 1

Outline of pharmaceutical calculations topics.

Calculations I

- I Introduction to Concepts: Units, Error, Percent Strength, Ratio Strength
- II Minimum Weighable Quantity (MWQ), Error, Sensitivity Requirement
- III Aliquots with solid measures
- IV Aliquots with liquid measures
- V Trituration with multiple steps

Calculations II

- I Introduction to Concepts: Dilution, Concentration
- II Algebraic Method for Concentration
- III Algebraic Method for Dilution
- IV Mass Balance Method for Dilution
- V Alligation Method for Dilution

Calculations III

- I Introduction to Concepts: Diffusion, Osmosis, Osmolarity, and Osmotic Pressure, Tonicity
 - II Sodium Chloride Equivalent Method with NaCl
 - III Sodium Chloride Equivalent Method with NaCl more than one ingredient
 - IV Sodium Chloride Equivalent Method with boric acid
 - V Freezing Point Depression Method
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