



Education



THE FLIPPED CLASSROOM IN EMERGENCY MEDICINE USING ONLINE VIDEOS WITH INTERPOLATED QUESTIONS

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Abstract—Background: Utilizing the flipped classroom is an opportunity for a more engaged classroom session. This educational approach is theorized to improve learner engagement and retention and allows for more complex learning during class. No studies to date have been conducted in the postgraduate medical education setting investigating the effects of interactive, interpolated questions in preclassroom online video material. **Objectives:** We created a flipped classroom for core pediatric emergency medicine (PEM) topics using recorded online video lectures for preclassroom material and interactive simulations for the in-classroom session. **Methods:** Lectures were filmed and edited to include integrated questions on an online platform called Zaption. One-half of the residents viewed the lectures uninterrupted (Group A) and the remainder (Group B) viewed with integrated questions (2–6 per 5–15-min segment). Residents were expected to view the lectures prior to in-class time (total viewing time of approximately 2½ h). The 2½-h in-class session included four simulation and three procedure stations, with six PEM faculty available for higher-level management discussion throughout the stations. Total educational time of home preparation and in-class time was approximately 5 h. **Results:** Residents performed better on the posttest as compared to the pretest, and their satisfaction was high with this educational innovation. In 2014, performance on the posttest between the two groups was similar. However, in 2015, the group with integrated questions performed better on the posttest. **Conclusion:** An

online format combined with face-to-face interaction is an effective educational model for teaching core PEM topics. © 2016 Elsevier Inc. All rights reserved.

Keywords—flipped classroom; online videos; interpolated questions; pediatric emergency medicine education; engaged educational sessions; curriculum innovation

INTRODUCTION

The concept of the flipped classroom is increasing in popularity, as evidence exists that it improves learner engagement and learning retention, affords more efficient face time, and allows more complex learning during class (1–7). Coined by two high school chemistry teachers in 2007, the term “flipped classroom” refers to an educational approach that reverses the traditional lecture and homework elements of a course (8). Students are given material in advance (such as text, online lecture, or podcast), allowing class time to be used for active learning exercises.

Background

The pediatric emergency medicine (PEM) faculty teach a modified 1-day advanced pediatric life support (APLS) course to the postgraduate year (PGY)-3 Emergency

medicine residents at Los Angeles County + University of Southern California Medical Center annually as part of the educational curriculum. This course is an overview of basic PEM care and is given to the PGY-3 class immediately prior to the start of their PGY-4 year. Historically, this course has consisted of 6 h of live, prewritten lectures on various topics, followed by a 2-h procedure laboratory. Anecdotally, residents and faculty reported this day to be long and somewhat arduous, with a time commitment disproportionate to potential learning benefit. The PEM faculty members were inspired to create a more engaging session that maximized educational impact in a more efficient manner.

Educational Objectives

1. Condense core advanced pediatric life support (APLS)/PEM curriculum to brief online lectures for online access.
2. Utilize class time for efficient, interactive sessions.

MATERIALS AND METHODS

Curricular Design

Four PEM physicians recorded multiple PEM topics for online video viewing. One physician lectured while two

physicians served as commentators during the lectures. These sessions were filmed and produced professionally by the Hippo Education studio. After extensive editing, 13 approximately 10-min online lectures highlighting 12 topics from the APLS course were uploaded to an online service called Zaption (www.zaption.com). Zaption allows forced interpolated questions integrated into the online lectures to reinforce concepts, and it also provides instant analytics including: number of views, average viewing time percent of video watched, and answers to interpolated questions (Table 1). Explanations to incorrect questions responses were given in real time.

One half of the residents were randomized to view online lectures uninterrupted (Group A), whereas the remainder (Group B) viewed with integrated questions (2–6 per 5–15-min lecture, see Table 1). All residents were expected to view the lectures prior to an in-class session (total viewing time of approximately 2½ h). The in-class session was <2½ h in length and included four simulation stations and three procedure stations led by six PEM faculty for higher-level management discussion throughout the stations (Table 2 for class schedule).

The University of Southern California's institutional review board approved this study as exempt. Seventeen PGY-3 Emergency Medicine residents participated in a

Table 1. Zaption Analytics of Pediatric Emergency Medicine Lectures

Lecture (Group)	Video Length (min:sec)	Average Viewing Time (min:sec)	Integrated Questions (#)	Percent Correct (%)	Average Skips Backward	Average Skips Forward
Airway (A)	7:54	6:35	0	NA	0.8	0.6
Airway (B)	7:54	5:37	3	60	0	0.5
Bronchiolitis* (A)	8:26	7:11	0	NA	1.6	1.9
Bronchiolitis (B)	8:26	8:21	4	72	0	1.3
Croup* (A)	10:34	9:57	0	NA	1	0.4
Croup (B)	10:34	10:26	4	72	0	0.1
Diabetic ketoacidosis (A)	12:10	11:10	0	NA	0.7	1
Diabetic ketoacidosis (B)	12:10	11:00	4	79	0	0.9
Fever I* (A)	13:40	11:45	0	NA	1.6	0.7
Fever I (B)	13:40	12:42	2	94	0	1.8
Fever II* (A)	11:55	10:38	0	NA	1.4	0.3
Fever II (B)	11:55	10:30	3	88	0	0.1
Head trauma (A)	9:37	8:26	0	NA	0.4	1.6
Head trauma (B)	9:37	9:11	3	96	0	0.2
Intubation (A)	14:54	12:49	0	NA	1.6	2.7
Intubation (B)	14:54	13:41	4	84	0	1.8
Neonatal resuscitation (A)	5:25	5:03	0	NA	0.6	0.6
Neonatal resuscitation (B)	5:25	5:03	3	82	0	0.2
NPPV (A)	13:56	12:27	0	NA	1	3.9
NPPV (B)	13:56	12:38	3	82	0	0.5
PALS update (A)	13:19	11:55	0	NA	2.8	1.4
PALS update (B)	13:19	12:43	4	88	0	0.7
Sepsis (A)	13:09	12:12	0	NA	1.4	1.2
Sepsis (B)	13:09	12:37	6	96	0	0
Status epilepticus (A)	14:44	13:51	0	NA	1.1	1.6
Status epilepticus (B)	14:44	13:04	5	79	0	1.7

NPPV = noninvasive positive pressure ventilation; PALS = pediatric advanced life support.

Group A viewed the lectures uninterrupted and Group B viewed the lectures with integrated questions.

* These groups have medical student viewing data combined with the resident views for a separate project.

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