Do students in a flipped classroom perform better on cognitive exams? The answer to the big flipping question.

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Introduction

A flipped classroom model is based on out-of-class learning for core content, followed by in-class application-level activities. Flipped classrooms are thought to enhance student-teacher interaction, student satisfaction, positive feedback from both students and instructors, and improved outcomes. Research has shown that this model is beneficial for students in STEM and nursing models. Data from a 2016 pilot study found a marginal increase in cognitive exam scores in a flipped OB module. The purpose of this study was to “flip” an entire EMT class from start to finish and examine if there was an impact on cognitive exam scores.

Hypotheses

a) Students receiving the flipped content will score higher on Fisdap unit exams than the national average.

b) Students receiving the flipped content will score higher on the Fisdap Entrance Readiness Exam 2 (ERE2) than the national average.

c) Flipped EMT programs will have higher NREMT cognitive exam pass rates than the national average.

d) Flipped EMT programs will have higher NREMT cognitive exam pass rates in 2017 than in 2016 when still using traditional teaching methods.

Materials and Methods

Four geographically different teaching institutions self-identified to utilize a flipped classroom delivery for the entire EMT class that consisted of similar material online via Jones & Bartlett Learning’s Navigate 2 course, followed by specific interactive learning activities in the classroom. Inclusion criteria consisted of student consent to research data points for the Fisdap Unit exams and the ERE2. Throughout the courses, students utilized the Navigate 2 material, participated interactively in class activities, and took the six 75-question Fisdap unit exams and the Fisdap ERE2. Upon completion of the course, students took the NREMT EMT cognitive exam. Parametric bootstrap tests were used to determine whether there was a difference in the mean achievement scores between students from a flipped classroom and students from non-flipped classrooms using different measures. Continuance tables looked at first-time passed/did-not-pass rates for all and participating schools in 2016 and then again for 2017 data.

Results

Fifty-one students from four geographically diverse schools participated in a flipped classroom. Nonparametric bootstrap tests were used to determine whether there was a difference in the mean Fisdap unit exam and ERE2 scores between students from a flipped classroom (n=51) and students from the rest of the country (n=2219) using different measures (see table below). For each measure, a Monte Carlo p-value was computed using 9999 bootstrap replicates from the data. Each p-value is computed is a corrected p-value using the suggestion by Davison & Hinkley (1997). All p-values were statistically significant at the 0.05 level. For each of the measures, this is evidence against the null hypothesis of no mean differences, and suggests that students from flipped classrooms may differ from the national average in scores in each of the measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Flipped Classroom</th>
<th>National Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisdap Airway</td>
<td>77 ± 7.1</td>
<td>71 ± 12</td>
</tr>
<tr>
<td>Fisdap Trauma</td>
<td>74 ± 11</td>
<td>68 ± 11</td>
</tr>
<tr>
<td>Fisdap Cardiology</td>
<td>75 ± 13</td>
<td>70 ± 11</td>
</tr>
<tr>
<td>Fisdap Ob/Peds</td>
<td>77 ± 13</td>
<td>69 ± 14</td>
</tr>
<tr>
<td>Fisdap Medikul</td>
<td>78 ± 28</td>
<td>71 ± 10</td>
</tr>
<tr>
<td>Fisdap Operations</td>
<td>60 ± 28</td>
<td>77 ± 10</td>
</tr>
</tbody>
</table>

Table 1: Descriptive statistics for flipped classrooms (n=51) and the national average (n=2219). Mean differences between the flipped classes and the national average are statistically significant at the 0.05 level for all measures.

Conclusions

Students’ cognitive scores from the flipped classrooms were significantly higher than students in the national sample on all six Fisdap unit exams and ERE2. Additionally, the exam averages for the flipped classrooms were all above the 75% cut scores for the Fisdap exam. These results have provided important implications due to the predictive nature of the Fisdap exams. More than 97% of students who pass Fisdap’s exam also pass the National Registry Cognitive Exam on their first attempt. These results also reinforce a 2016 pilot study, finding that cognitive scores on the Fisdap OB section of the OB/Peds unit exam were higher for students in the flipped classroom. This in comparison to students who flipped to themselves prior to flipping the classroom, a greater percentage of flipped classroom students passed the National Registry Exam than compared to students that learned in a traditional setting. These findings suggest there may be a positive correlation between flipped classrooms and success on the National Registry EMT Exam. Despite the small sample size, these results align with evidence from other disciplines suggesting that EMT students have higher cognitive competency in a flipped classroom setting.

Limitations and Future Research

Ten schools were initially invited to participate, but only four were able to meet the parameters of the study and have their data included, thus limiting the sample size. Additionally, while all participating programs were provided the same material, programs were allowed to interpret and practice the recommendations as needed. Finally, due to being a retrospective study, not all participating programs used Fisdap exams prior to the flipped classroom, which limited the ability to compare previous Fisdap unit exam scores within each program. Future research with a larger sample size, more standardization of material, and the use of control groups are needed to determine if the increase in cognitive scores is, in fact, due to the flipped classroom and not another variable. Future research should also investigate the impact of flipped classrooms on psychomotor performance and retention and successful employment and performance in the field.

Acknowledgments and Disclosures

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