A Flipped Classroom Design for Circulatory System in Medical School Gross Anatomy: Impact on Student Performance and Attitudes

Shannon N. Curran

Committee: Dr. Danielle Royer (Capstone Mentor), Dr. John Caldwell (Capstone Chair and Advisor), Dr. Mike Carry (External Reviewer)

A Flipped Classroom Design

A flipped classroom design diverges from traditional lecture instruction in that “lecture” is done outside of class and “homework” is done in class (Fig. 1). The goal of the study was to develop materials for a flipped classroom, determine student attitudes towards flipped classroom instructional methods, and evaluate educational effectiveness of a flipped classroom design.

New Flipped Classroom Curriculum

• Introduced Fall 2016, in 1st year medical school gross anatomy course at University of Colorado School of Medicine.
• 3 regional anatomy units, 6 study tools, and 9 in-class active learning sessions (Fig. 2)
• Study tools and in-class sessions aligned with course learning objectives (Fig. 3)

Methods

Step 1: Develop FC Material

- Study Tools (6)
  - Regional circulatory system content
- In-Class Sessions (9)
  - In-class blood flow cases and image based activities

Step 2: Evaluate FC Material

- Educational Effectiveness
  - Compared grades of 2015 (TC) to 2016 (FC) cohorts

Step 3: Evaluate FC Impact

- Future Directions
  - Evaluate student use of study tools outside of class, performance on practice quizzes, and enhance study tools based on feedback
  - Develop further flipped classroom content for gross anatomy education (i.e., nervous system)
  - Evaluate FC impact on long term retention

Results

• Class performance was analyzed on individual flow question items for each unit exam
• Summary statistics were calculated for each item. A nonparametric Mann-Whitney U test was used to compare mean scores between 2015 (TC) and 2016 (FC) cohorts.

Step 1: Study Tools

- Six PowerPoint self-study tools were created
- Each contained animated line drawings (shown in image to left) to draw along with
- Each contained test pop-ups containing key relationships and concepts

Step 2: Educational Effectiveness

- Response rates were 47.8%, 33.7%, and 35.3% across the units; mean ratings for all items ranged from 4.3 to 4.6 out of 5.
- No significant differences (p > 0.05) were observed between identical questions on the three unit surveys, indicating high student satisfaction with the new curriculum across all regional units (N=184 for both cohorts).
- Student ratings of the in-class blood flow and image-based activities showed a significant positive correlation (p < 0.001).

Step 3: In-Class Sessions

- Practice blood-flow cases were provided for small group work
- One was provided before class, while a new case was provided in class

Step 4: Educational Effectiveness

- Anatomical illustrations were given with key concepts and structures to ID
- Students were quizzed on key relationships and identifications

Conclusions

• A general theme analysis of survey responses indicated approval of the FC with suggestions for future improvements.
• Comments were grouped as Positive Comments, Suggestions, or Criticisms.

Results

- Mixed impact on academic performance suggests both traditional and flipped classroom strategies are effective for learning circulatory content
- Students agree the flipped classroom approach facilitated their learning, and perceive the flipped classroom as highly effective
- Blood flow case practice and image-based Q&A sessions were both viewed as valuable in-class activities

References


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