Improving Student Learning Gains and Attitudes Using Flipped Format Instructional Approach

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Abstract. Many educators provide content online outside of classroom and use the class time for engaging students in activities targeted at higher levels of learning taxonomy. We have been experimenting with this inverted or flipped classroom format at Cal Poly Pomona using SmartPhsyics multimedia Prelectures and checkpoints. We have found this method better prepares student for the class activities and also allows more class time for the instructor to assist students when they are applying the concepts and practicing problem-solving skills. Our research indicates that this method creates a better classroom experience and makes each component of the course more valuable to students.

1. Background

Flipped classroom is the pedagogy in which students gain first-exposure to course content prior to class by reading, watching, listening, and interacting with content on their own time online [1], [2]. As a result, they come to class better prepared to take active roles in classroom discussions, peer instructions, group work, and problem-solving practices. In terms of Bloom's taxonomy, this means students do the lower levels of cognitive work (gaining initial knowledge and understanding) outside of class, allowing instructors to use precious class-time for more demanding cognitive tasks (application, analysis, synthesis, etc.) while students have the support of their peers and instructor.

2. Research Study

In this presentation, we discuss a flipped introductory physics course in which students viewed 15-20 minutes online multimedia pre-lectures and took online quizzes before each face-to-face class meeting. A series of active learning strategies such as reflective metacognition, whiteboard group problem solving, peer discussion, conceptual mini tutorials, visual simulations, and lecture demonstrations were incorporated into the class time. A Blackboard course template was also developed to make relevant classroom materials available to students in weekly basis [3], [4].

We are using https://www.flipitphysics.com/ as the online content delivery at California State Polytechnic University in Pomona and are evaluating their effectiveness in student learning of introductory calculus-based physics courses. Students were required to view the prelectures before each face-to-face class meeting. We will share the detiasl of the course struture and its impact on student performance in these courses.

In order to study the impact of this approch, we calculated the normalized gain $< g >$, which is the ratio of the actual to the maximum possible gain:

$$< g >= \frac{(posttest - pretest)\%}{(100 - pretest)\%} \qquad (1)$$

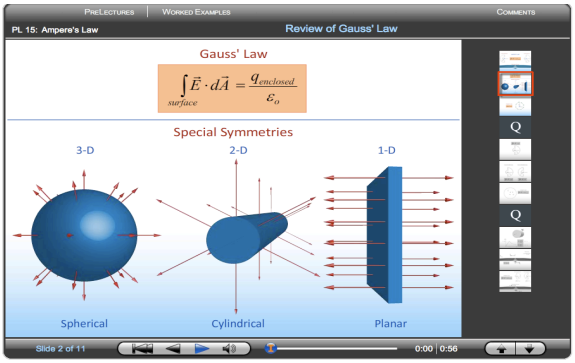

Fig. 1 Screenshot of the online Flipit prelecture.

We also calculated the Effect Size (ES), which is a statistical concept that measures the strength of the relationship between the two variables and reflects the standardized mean difference by dividing the two population mean differences by the standard deviation of the control group:

$$ES = \frac{\overline{\mu}_1 - \overline{\mu}_2}{\sigma} \qquad (2)$$

The ES about 0.2 corresponds to a small effect, while 0.5 is considered a medium effect, and 0.8 and greater reflect a large effect size.

3. Conclusion

According to our data, the flipped method course resulted in higher average learning gains measured by normalized pre/post Force Concept test data:

as well as enhanced student class engagement when compared to traditional instruction. In addition, student attitudes regarding the online pre-lectures were extremely positive; they enjoyed the flexibility associated with the online course material, felt they were easy to use, and found the presentations and examples to be effective in helping them learn the material.

References

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