
**Categories:** Active learning, student centered learning, flipped classroom, discussion, STEM

**Summary**

This article examines an effort, on the part of the authors, to create a learning environment that fostered mathematical thinking outside of the class and college level discourse within it. According to the authors their goal was “to develop a sense making community of mathematical learners.” With this objective in mind, they built a model of the Flipped Classroom that rested on three principles: use out of class time to encourage student reflection and practice; use of class time to develop new knowledge “as part of a learning community;” and connect out of class and in class tasks through the use of the active learning.

Their model of the Flipped Classroom employed a four step process. In the first step, what the authors referred to as the “launch phase,” students were asked with watching a two to five minute video. The video gave the students a mathematical task, reviewed prior knowledge and related concepts that might prove useful in completing the task, and solicited student solutions. In the second stage, or the “exploration phase,” students used prior knowledge to work through the task and submit their responses online prior to the beginning of the next class session. This provided students with an opportunity to develop skills and thoughts necessary to come to class prepared and provided the instructors with a set of formative assessments. In the presentation phase, the instructors called upon some students to present their work to their peers. After these presentations, the process entered its final step, the discussion phase, in which the whole class discussed the solutions offered in the third step.

After outline the process they used to flip their classrooms, the authors offered a description of a class session in which the students examined the topic of inverse functions as an example of their model in action. The objective of the lesson was to develop a definition for inverse functions that the whole class could agree upon. The authors developed a two minute video that reviewed class discussion pertaining to related topics and asked students to reflect upon “the special case of two functions that ‘undo’ each other.” At the start of the next class session the instructors handed out sheets that listed the students’ responses. Then, the students worked in groups to determine the correct formula to a problem that applied the concept of inverse functions. Within the groups students were instructed to defend their solutions to their colleagues, and asked the groups, after arriving upon a consensus, to write their solutions on the board. Next, the whole class engaged in a discussion that compared the proffered solutions and definitions. The discussion led to new thoughts on an appropriate definition and concluded with a further problem to test the students’ ideas.

**Conclusions**

Based on their observations, the authors surmised that the crucial benefit of the Flipped Classroom was that it shifted instruction on foundational information to out of class time and, in so doing, allowed
students to come to class prepared and confident that they could engage the task at hand. This in turn promoted much richer discussions involving mathematical thinking. Finally, the authors concluded that their application of the Flipped Classroom promoted greater equity in learning and participation by allowing students the time, out of class, to develop the thinking necessary to lesson at hand.

Applications

Overall, this article offers a rather succinct model of the Flipped Classroom. The process described could be easily applied in almost any math course with little revision. It could likely also be adapted to fit any number of other content areas. For example, I could follow this relatively simplistic model to pose a question of historical interpretation, provide a brief video lecture of power point laying out related material or information, solicit responses from students, and then have students examine the range of opinions expressed by their peers. This model of the Flipped Classroom could be applied in any class in which the objective is developing the thinking process used to arrive at solutions to a given problem. In a broader sense, the model could also be utilized to engage students in other cognitive tasks. Perhaps most encouraging, the authors have also outlined a process by which they bolstered the discursive aspect of the learning environment. The limitation here, of course, is that the authors have offered little supporting evidence for their conclusions other than the vignette they described.

Citations of Interest
