TEACHERS' MOTIVATIONS AND CONCEPTUALIZATIONS OF FLIPPED MATHEMATICS INSTRUCTION

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Although an increasing number of teachers report flipping a lesson or their entire class, little is known about what leads teachers to this decision or how they implement flipped instruction. Understanding these factors is important because it can allow teacher educators and researchers to investigate ways to support teachers in enacting practices that can achieve their goals and improve student learning. In this study we examine two teachers' motivations for and conceptualizations of flipped instruction. We discuss the ways in which these motivations aligned, or not, with their enactments and suggest implications for research and practice.

Keywords: Instructional Activities and Practices, High School Education, Technology, Curriculum

Although a majority of teachers report flipping (Smith, 2014), research has not kept pace. Further, studies of flipped instruction tend to treat it as a uniform approach in which teachers assign lecture videos for homework and do problem sets in class (e.g., DeSantis et al., 2015). Our study, however, has revealed great variation among flipped classes in terms of both the homework assigned and the work conducted in class. It is also likely that teachers have different motivations for implementing flipped instruction. We examined two mathematics teachers' motivations for and conceptualizations of flipped instruction in order to better understand varying perspectives of this instructional model.

Background

Teachers have long been central to innovations and reforms in mathematics education and their perceptions of such efforts are important to consider. Smith (1996) revealed that teachers' feelings of self-efficacy shifted with reform efforts because high-quality teaching was no longer equated with giving clear demonstrations. Similarly, the rise of flipped instruction may entail a new set of skills associated with high-quality teaching, such as creating compelling videos for homework or the ability to facilitate discussions in class that build on video homework.

Adopting flipped instruction may also be analogous to adopting new curricular materials. Lloyd (2008) found that such changes take time for teachers as they have to manage both the students' expectations of how to participate and their own comfort with the new curricular vision. Although flipped instruction is not a curriculum, it still requires teachers to grapple with the purposes of homework and in-class activities and to manage students' expectations of their role in their own mathematics learning. Some literature is emerging (e.g., Moore, Gillett, & Steele, 2014; Palmer, 2015) with first-hand accounts of instructors' experiences flipping and we add to this work by answering the following questions: What were the teachers' motivations for flipping their mathematics classes? How did they intend to enact flipped instruction and what did they perceive to be the outcomes of doing so? This work can help inform the development of support for teachers who are flipping their classes and direct future research on flipped learning.

Method

Two teachers participated in this qualitative study. Ms. Schaefer was a mathematics instructor at a community college and taught a flipped college algebra course. Though she had flipped lessons previously, the course we observed was the first she had fully flipped. In contrast, Ms. Temple, an eighth grade teacher, had been flipping her mathematics course for five years.

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We conducted three cycles of observation in Ms. Schaefer's class. For each cycle we conducted audio-recorded pre- and post-lesson interviews to allow Mrs. Schaefer to describe the lesson we observed and her instructional decisions related to the flipped format. We also video recorded the three lessons. Additionally, we collected copies of Ms. Schaefer's videos and any tasks she used in class. Ms. Temple's data was collected from a distance and so we conducted a single initial interview with her. We conducted two observations in Ms. Temple's class, complete with video recordings and copies of her instructional materials. We also collected survey data from the teachers, which consisted of 48 item (26 multiple choice, 22 open-ended) in order to identify their implementation and perspective about flipped instruction. For the present study, the primary data sources include the interviews, surveys, and course materials.

With regard to analysis, the research team first identified sections of the interview and survey data in which the teachers discussed flipped instruction. The team then open-coded (Strauss & Corbin, 1990) these excerpts using analytic memos focused on the particular aspects of instruction the teachers discussed. From this initial coding, we met to collapse codes into the following themes: flipped experience, flipped benefits, flipped struggles, flipped in-class work, flipped at-home work, views of students, video use in class, vision of flipped instruction, students' needs, resources for flipped, student experiences, differences between flipped and traditional, and student views of flipped. These themes were used to examine each teachers' perspectives in relation to the research questions.

Findings

In this section we discuss the teachers' motivations for flipping their instruction, then discuss the ways in which the teachers conceptualized their enactments and the perceived outcomes from it.

Motivation for Flipping

Ms. Temple began flipping her class five years ago after learning about other teachers who were flipping. She discussed a specific encounter with a colleague as an impetus for flipping:

> He just said, "Hey, I think you should try this. It's really cool how much time you get with your kids in class. I think you would love it." After he bugged me for a couple months, I said, "Alright, what the heck, I'll try it." So I tried it with my advanced class and I was like "Oh my gosh, this is so cool!" … I can talk to these kids and physically see what they are doing.

Her colleague's encouragement led to Ms. Temple's implementation of several flipped lessons. However, she did not fully flip an entire course until her student teacher worked with her to develop a set of video lessons. Once she had created the videos and implemented the lessons, Ms. Temple said that her students' engagement served as encouragement to continue flipping.

Similar to Ms. Temple, Ms. Schaefer began flipping her class after hearing about the benefits of flipping from other teachers. Ms. Schaefer's motivation centered on her desire to increase interaction with students and she was drawn to the prospect of helping students develop deeper mathematical understandings. "I liked the idea of having time to deepen the understanding of math and make the real world connections that you typically do not get to do."

Enactments of Flipped Instruction

In addition to the similarities driving their initial forays into flipped instruction, both teachers had nearly identical ways of defining flipped instruction. In her survey response, Ms. Schaefer defined flipped instruction by describing the students' experiences, "Students watch prepared videos or reading assignments prior to class. Then we use class time to really dive into the material and get a better understanding of the concepts." Ms. Temple provided a similar definition of flipped instruction in her survey response, "I see flipped instruction as a method to deliver the basic content outside of

class and then work together and dig deeper in class together." The teachers viewed the underlying structure of this format as one in which teachers assign instructional videos for homework and practice problems in class. Despite their agreement that flipped instruction provides teachers the opportunity to provide students with a deeper understanding of mathematics, the teachers' visions for the day-to-day implementations differed.

At-home activity. Students in both teachers' classes were assigned instructional videos to watch at home. Rather than select ready-made videos such as those from Kahn Academy, the teachers created their own videos. Ms. Schaefer's videos were created using an iPad application that allowed her to capture her explanations as she wrote on her iPad. Ms. Schaefer expected her students to watch the videos and take notes as though they were attending a typical mathematics lecture. Although Ms. Temple also created lecture videos, her students' homework included those videos in conjunction with mathematics problems aligned with the videos' content. This was possible because Ms. Temple used iBooks to develop her homework. The iBooks format allowed her to include text, video, and interactive questions in a single file.

Although both teachers' homework assignments were meant to instruct students on the mathematical concepts, their instructional videos highlighted differences in their instructional practice. Ms. Schaefer presented information to the students and included a number of examples. She also pointed out a number of common pitfalls students should avoid. In contrast, Ms. Temple's homework included many anticipatory questions or activities followed by examples and explanations of a particular concept. This instruction was then followed by further opportunity for students to complete related problems. More drastic differences were evident in the teachers' conceptualization and enactment of in-class activity, as described below.

In-class activity. Ms. Schaefer and Ms. Temple had different conceptions for how to utilize in their class time with students. When deciding how to utilize her in-class time, Ms. Schaefer developed a routine for her flipped mathematics class. She referred to her format as "30-30-30." This meant that for each 90-minute class, she would spend the first 30 minutes answering students' questions on the homework video, the second 30 minutes on worksheets that she had created to reinforce the ideas from the video, and the final 30 minutes for students to complete practice problems and ask questions. Because the students tended to work at their own pace and there were no planned whole-class discussions during these segments; the students tended to work independently or with partners throughout the entire class. During this time, Ms. Schaefer walked around to provide assistance as needed.

Ms. Temple's in-class implementation differed substantially from Ms. Schaefer's. Ms. Temple did not have a fixed format but she did have several typical routines she followed.

> When they get to class they sit in groups of three or four facing each other. Typically, there is a math starter when they walk in … And then normally they go into their team discussions … then they practice in class. And it's kind of old school math practice. It might be textbook problems. It might be a handout … And then they do a quick check … Then the process starts all over again. And they usually go home with "You're going do these two pages in your notes. Here is the reading part and the video that goes along with it." And then we just repeat the cycle. And not every day is just practice. But that is just kind of more typical.

Ms. Temple's class included more purposeful grouping of students and several points at which she checked in with the whole class. Thus, while students in both classes were given some flexibility in terms of the pace at which they worked, Ms. Temple's students were typically at a similar point at the end of class because of the routine check-ins whereas Ms. Schaefer's students tended to have more variation in how far they progressed by the conclusion of a class meeting.

Perceived Outcomes from Flipped Instruction

Both teachers' discussions of the benefits of flipped instruction centered on students' collaboration in class. Ms. Temple described the defining difference between her flipped and traditional classes as student engagement, saying, "In my traditional class they (observers) wouldn't hear kids talk as much… In my flipped class, kids are talking all the time about math… and helping each other all the time." Ms. Schaefer similarly reported collaboration as the big difference between her traditional and flipped classroom. Thus, both teachers thought that because instruction was delivered via homework, the flipped model freed up class time for students to work together on mathematics.

Although the teachers agreed that the additional class time was beneficial, they reported different impacts of flipped instruction on their relationships with students. Ms. Temple said flipped instruction allowed her to develop deeper relationships with her students. She said, "I think I know my students better than I ever have, both mathematically and not mathematically." Ms. Schaefer did not feel the same way and discussed that she found it harder to build relationships with students because she only interacted with them when they had questions.

Conclusion

Ms. Schaefer and Ms. Temple had similar motivations for flipping their instruction but there was variation in the degree to which the motivations aligned with their enactments. Both teachers desired to enhance opportunities for students to develop conceptual understanding but the teachers differed in the ways in which they structured class time and activity for students to develop these understandings. For both teachers, the vast majority of their preparation time was spent on creating the video homework but they recognized the in-class time was perhaps even more vital with regard to the students' mathematical learning. Future research in this area should attend to both the at-home and the in-class portions of flipped instruction and should consider the potentially new skills and challenges that may arise from enacting flipped instruction.

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