SUCCESSES AND CHALLENGES FROM EARLY CAREER MATHEMATICS TEACHERS

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Despite working towards a common vision for teacher preparation, newer teachers experience successes and challenges in their teaching. This study investigated the experiences of three third year teachers to identify what they found successful or challenging in their teaching. Findings indicated that successes or challenges were contextually dependent upon the individual, though common themes across experiences existed.

Keywords: Professional Development, Teacher Knowledge, Preservice Teacher Education, Informal Education

National standards documents identify a vision of what teacher preparation should be, indicating that preservice teachers need preparation centered on knowledge of mathematics, how students learn mathematics, and mathematics pedagogy aligned with effective and equitable teaching practices (AMTE, 2019; CBMS, 2012). However, teaching mathematics requires integrating and using this knowledge (Barker et al., 2019), which can be challenging and mostly learned once a newer teacher is positioned in their own classroom (Feiman-Nemser, 2001). Scholars have described teachers with less than three years of experience as novices (Arbaugh et al., 2015; Lampert, 2010) or advanced beginners (Berliner, 2004). Research in mathematics education has investigated the classroom practices of veteran teachers (Ball & Forzani, 2011; Borko, 2004), providing limited insight into experiences of secondary mathematics teachers with less than three years of experience.

Literature Review

Berliner (2004) developed a theory describing a progression that teachers move through as they build their expertise. We describe the first two stages here. The first stage, the novice stage, is experienced by first year teachers. Teachers in the novice stage are inflexible, desire conformity and compliance, and use rules absolutely. Novices are gaining experience and learning common structures and expectations of the school they work in. The second stage, the advanced beginner stage, is often experienced by second- and third-year teachers. Teachers in this stage begin to leverage their experiences to inform their classroom sense-making and decisions. Advanced beginners recognize contextual similarities across their experience and begin to develop a more flexible, nuanced collection of practical knowledge for teaching.

Classroom management is a common challenge newer teachers encounter (e.g., Evertstein & Weinstein, 2006). McCormack, Gore, and Thomas (2006) described classroom management as actions teachers take to establish and maintain an orderly classroom learning environment that supports meaningful academic learning. They suggested that newer teachers abandoned research-based instructional practices in favor of textbook-driven instruction because they had not yet built the more flexible and practical knowledge needed to deal with extreme student behavior. Similarly, Hover and Yeager (2004) found that newer teachers' instructional approaches frequently did not facilitate group work or student-engaged lessons because they did

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not want to risk losing control during the lesson. Notice these perspectives of classroom management focused on the teacher exerting inflexible control and compliance (Berliner, 2004).

Research has also indicated that teachers' instructional practices evolve during the first few years of their teaching careers (Berliner, 2004). When following ten mathematics teachers through their first two years of teaching, Grossman et al. (2000) found that teaching practices learned in methods coursework were not evident until the teacher's second and third years of teaching. Similarly, Ensor (2001) found that despite first year mathematics teachers having knowledge of and being able to talk about research-based practices, they did not facilitate such practices in their own classrooms. Decisions were often justified in terms of student behavior issues and their beliefs about students' learning abilities. Taken together, these findings suggest that much of the learning from teacher preparation might develop through experience (Ward et al., 2011) and the activity of teaching over time (Berliner, 2004; Rhoads & Weber, 2016).

In this study, we explored experiences of third year teachers working in secondary school mathematics classrooms. Specifically, we address the following questions.

4. What aspects of teaching do third year teachers talk about when prompted to share their successes and challenges?
5. Were these aspects of teaching described as successful or challenging by third year teachers?

Methods

The three participants in this study graduated in the same cohort from a one-year Master of Arts in Teaching (MAT) program from a state university in the southeastern region of the United States. Participants had already earned an undergraduate degree in an area related to mathematics and were seeking state certification and a master's degree. The MAT focused primarily on general and mathematics pedagogy. After graduating, each participant requested one of the authors serve as their university mentor as required by their new teacher induction program. The first author served as a mentor for one participant, and the second author for two participants. All participants were female and in their third year of teaching when data was collected. One participant, Rachel, taught 8th grade in a small rural school serving a nearly all White student population. The other two participants, Kelly and Lola, taught Algebra and Geometry high school courses in large suburban schools. The courses taught were composed of predominately Black and Latinx student populations.

Data was collected during the entire 2019 – 2020 school year, including midway through the spring semester in which the COVID-19 pandemic began. Data came from regularly scheduled conversations, typically once every two weeks. Conversations focused on successes and challenges participants had encountered during the past couple of weeks, what made these events successful or challenging, and how they saw their preparation helping or hindering in addressing them. Kelly engaged in these conversations solely through email, Lola with a combination of email and audio recorded conversations in-person, and Rachel through a combination of text and video messaging though the phone application, WhatsApp.

Analysis

Once data collection was complete, all data sources were transcribed into a single chronological transcript for each participant. Each transcript had the Data Reduction Method (Miles, Huberman, & Saldana, 2014) applied to it to identify sections of it where the participant was responding to a prompt or question regarding successes or challenges in their classroom

practice. If the participant shared multiple topics in responding to this question, each topic was treated as its own section. This resulted in a total of 66 sections across all three transcripts. Next, each section was read to identify episodes—a portion of the section that was describing a single idea, issue, or thought. Some sections in the transcript contained a single episode, whereas other sections contained multiple episodes. The total number of episodes across all three transcripts was 123. These episodes served as the unit of analysis for this study and were coded using an inductive and deductive coding process.

Topics newer teachers talk about. The deductive coding process began with a list of topics that were used in the mathematics methods for teaching courses all participants had taken during their university preparation program. All participants had taken a sequence of two mathematics methods courses taught by the first author during their preparation program. Each episode was read and if a topic from the methods topic list appeared to match, it was tagged with this topic. If an episode did not seem to align with a topic on this list, it was left untagged. All episodes that were tagged with the same topic were then read to develop a description that could be used to identify them. The collection of these descriptions was then refined and applied back onto the collection of all episodes to identify those they matched with. This cycle of applying these codes and refining their descriptions was iterated until the descriptions solidified and both authors agreed with all coding. This process was quite similar to the Constant Comparative Method (Glasser & Strauss, 1967), but not exactly the same as we began by deductively applying a list of codes (i.e., methods topics) onto the episodes rather than having them emerged from the episodes (i.e., inductive development of codes).

For all episodes that were not associated with one of the tags from the methods topic list, an inductive coding process was used—the Constant Comparative Method (Glasser & Strauss, 1967). Episodes were read and sorted into categories containing a single theme. A description was developed for each category and these descriptions were then applied back onto the episodes to ensure the description captured only the desired category's episodes. The cycle of developing a description and applying it back onto the collection of all episodes was iterated until the descriptions stabilized and both authors were in agreement with all coding.

Classifying topics talked about as successful or challenging. Each episode was also classified as being perceived as successful or challenging using the following process. First, if a participant named the experience as successful or challenging, it was classified that way. Next, if a participant did not name the experience directly, the following descriptions were used.

- Successful – describing what a newer teacher a) can do or accomplish, b) feels confident about, or c) expresses a desirable behavior or result
- Challenge – describing what a newer teacher a) cannot yet do or accomplish, b) does not feel confident about, or c) expresses an undesirable behavior or result

Note that these descriptions sought to consider the episode from the perspective of the teacher as whether they observed the event as being successful or challenging. Viewing these experiences from other's perspectives (e.g., administrator) may have resulted in a different classification. Third, if the episode did not fit within these descriptions, the episode was examined to see if it contained an actionable plan. If so, the episode was classified as a success. If an actionable plan was not described, then the episode was classified as a challenge. It is important to note that a small number (5) of episodes contained evidence of both success and challenge descriptions. For these episodes, they were classified as both a success and a challenge.

Findings

In this section we report our key finding from the analysis conducted. These findings are separated into two sections, each corresponding to one of our two research questions.

Research Question One

Recall that our first research question investigated what aspects of teaching newer teachers talked about when asked to share their successes and challenges. The way participants spoke about their successes and challenges rarely referenced aspects of student mathematical thinking and learning. Rather, mathematics and the mathematics classroom appeared to serve as context to the space where participants operated within.

Our analysis indicated that newer teachers talked about a variety of topics. Although there were 123 episodes coded in total, the table below includes topics with counts of five or more. Including only these topics was done to a) focus on the most common topics talked about and b) work within space limitations. These 77 episodes accounted for 63% of all of the episodes coded.

Table 1: Descriptions and Frequencies of Common Topics Teachers Talked about for All Participants

Topic	Description	Frequency
Classroom Management*	The teacher describes a situation focusing on non-mathematical undesirable individual student behaviors, sometimes including a management decision.	22
Engagement*	The teacher identifies or describes an external student behavior regarding participating in an aspect of mathematics lesson or learning mathematics, often as an aspect in need of cultivation.	19
Interpreting and Making Sense of Student Thinking*	The teacher hypothesizes about an underlying reasoning, rationale, or sensibleness for student behaviors, statements, or actions (mathematically related or not) that initially seemed nonsensical.	8
Pragmatic Teaching Strategies*	The teacher describes a specific pedagogical course of action for supporting student's learning that occurred outside of class time.	7
"Unit"/Long-Term Planning	The teacher describes an aspect of preparing for teaching that is not focused on an individual lesson, but planning that focuses on sequences of lessons.	6
Teacher Student Rapport	The teacher describes an experience focused on developing the relationship between the teacher and student(s), or a situation that highlighted the utility of an existing teacher-student relationship.	5
Motivation*	The teacher identifies or describes an internal student disposition towards school or learning mathematics, often as an aspect in need of cultivation.	5
Differentiation*	The teacher describes a situation where they are responsible for teaching at topic and making it accessible for varying ability levels.	5

Note. An asterisk (*) indicates a topic that was examined in the mathematics pedagogy courses completed by participants during their university MAT program.

The most common topic newer teachers talked about was Classroom Management, which was consistent with other research findings (e.g., McCormack et al., 2006). Episodes classified this way contained statements focusing on undesirable student behavior that was non-mathematical in nature. For example, consider the excerpt below from Kelly.

> I have one student that sleeps every day. I attempt to wake him up at least five times a class. I have emailed and called the parent but have never gotten a response. He has met with the counselor and still no luck.

Notice the focus is on responding to this student's behavior to change it. Kelly stated specific actions she had taken, though it has not resulted in the behavior she desired, which epitomizes the description of Classroom Management. Although Classroom Management focused on student behavior, it was not the only topic that did so.

The second most common topic newer teachers talked about was Engagement. Notice both Classroom Management and Engagement focus on an external characteristic—student behavior. What distinguishes Engagement from Motivation is that Motivation is an internal disposition (i.e., student controlled) whereas Engagement is an external action (i.e., teacher influenced). For example, consider the Engagement excerpt below from Rachel.

> I had half of my Algebra class not do their homework one day this week. I was prepared and had the homework assignment on paper. I had them do it at lunch, and I had about four of them refuse to do any of it. I had several in another class tell me that they just guessed on a test question instead of actually trying. We were doing test corrections, trying to learn from our mistakes. And multiple admitted they didn't try.

Notice Rachel's decision to be prepared and have the homework assignment on paper so students can make test corrections during lunch, continuing to press students to engage mathematically. She described this in conjunction with student behaviors regarding choosing (not) to work with mathematics, illustrating the description of Engagement.

In addition to their aggregates, we also separated these counts by participant (see Table 2).

Table 2: (Relative) Frequencies of Common Topics Teachers Talked about Separated by Participant

	Kelly	**Lola**	**Rachel**
Classroom Management*	3 (23%)	12 (24%)	7 (12%)
Engagement*	2 (15%)	9 (18%)	8 (13%)
Interpreting and Making Sense of Student Thinking*	---	3 (6%)	5 (8%)
Pragmatic Teaching Strategies*	---	7 (14%)	---
"Unit"/Long-Term Planning	---	1 (2%)	5 (8%)
Teacher Student Rapport	---	3 (6%)	2 (3%)
Motivation*	2 (15%)	3 (6%)	---
Differentiation*	2 (15%)	2 (4%)	1 (2%)
Totals	9 (68%)	40 (80%)	28 (46%)

Note. Totals are less than 100% because participants spoke about topics that had counts of less than five, which were not included in this manuscript as described above Table 1.

The topics that every participant talked about were Classroom Management, Engagement, and Motivation. Although these were talked about by each participant, notice how often they talked about each was not the same. For example, Rachel talked about Classroom Management (12%) about half as often as either Lola (24%) or Kelly (23%). Additionally, notice how much more common it was for Kelly to talk about Differentiation (15%) in contrast to Lola (4%) or

Rachel (2%). Although participants were more consistent in how often they talked about Engagement, it still varied from 13 – 18%.

This separation by participant also identifies variation in how commonly each participant talked about these most prevalent topics. For example, notice how these topics constituted 80% of what Lola talked about, whereas they were 46% of what Rachel spoke on. Moreover, we can see that some topics were unique to a single participant (i.e., Lola's Pragmatic Teaching Strategies) or a pair (e.g., Rachel and Lola both speaking about Interpreting and Making Sense of Student Thinking). Overall, data suggest the relevance of each topic to the individual varied.

Research Question Two

Recall that our second research question investigated if the topics newer teachers talked about were described as challenging or successful to them. Our analysis indicated that newer teachers varied in what they talked about as challenging or successful. Although there were 128 codes of challenges or successes (recall that five episodes contained evidence of both success and challenge descriptions), the table below includes topics with counts of five or more. Including only these topics was done to a) focus on the most common topics talked about as successful, challenging, or both, and b) work within space limitations.

Table 3: Frequencies of Challenges and Successes for Common Topics Teachers Talked about for All Participants

Topic	Challenge	Success
Classroom Management*	12	12
Engagement*	14	7
Interpreting and Making Sense of Student Thinking*	5	3
Pragmatic Teaching Strategies*	2	5
"Unit"/Long-Term Planning	2	4
Teacher Student Rapport	---	5
Motivation*	4	1
Differentiation*	3	2
Totals	42	39

The total ratios of challenges to success for the most common topics was balanced. Although ratios varied depending upon the topic, some topics were more often talked about as successful. For example, consider the excerpt below from Rachel on the topic of Teacher Student Rapport, which was only spoken about in terms of successes.

> I've started writing thank you notes every Friday. I've done it three straight weeks now. I write one to a student in every class. I'm trying to find value in every student, so they know I care. I've gotten a couple hugs and several 'thank yous' so I think it's going well so far.

Notice Rachel's focus on building connections with students, exemplifying the description of Teacher Student Rapport. She identified the desired result (i.e., recognition from students, states "I think it's going well"), aligning with the description of a success.

Although multiple topic's ratios were skewed towards successful, not every topic talked about was referred to this way. For example, consider the excerpt below from Lola on the topic of Interpreting and Making Sense of Student Thinking.

> I want my students to benefit from the projects and reviews that I am giving to improve their grades, but the group that I want to take these opportunities is not. I know that students have

many things going on besides academics though, and by this time of the year they are exhausted.

In this excerpt, Lola stated a possible reason for why the group of students did not take advantage of the opportunity to improve their grade, typifying the description of Interpreting and Making Sense of Student Thinking. This also aligns with the description for a challenge via the undesirable result (i.e., the group of students not capitalizing on this provided opportunity).

In addition to their aggregates, we also separated these counts by participant (see Table 4).

Table 4: Ratios of Challenges to Successes for Common Topics Teachers Talked about Separated by Participant

	Kelly	Lola	Rachel
Classroom Management*	3:1	6:6	3:5
Engagement*	2:0	5:4	7:3
Interpreting and Making Sense of Student Thinking*	---	3:0	2:3
Pragmatic Teaching Strategies*	---	2:5	---
"Unit"/Long-Term Planning	---	0:1	2:3
Teacher Student Rapport	---	0:3	0:2
Motivation*	2:0	2:1	---
Differentiation*	1:1	1:1	1:0
Totals	8:2	19:21	15:16

Separating these counts by participant highlighted some differences. Although the overall challenge to success ratio was balanced (42:39) and that Lola and Rachel's ratios were nearly balanced, Kelly's ratio was heavily skewed towards challenges. Of Kelly's successes, one episode was Classroom Management classified as both a challenge and a success, and the other was an episode about Differentiation. Although investigating Kelly's episodes did not provide insight as to why this skew towards challenges occurred, we wondered if Kelly was still in Berliner's (2004) "novice" stage, or perhaps limited resources (Ward et al., 2011) influenced this skew.

We also noticed some topics had variation in the ratio between challenges and successes between participants, whereas others were consistent. For example, Classroom Management was nearly always challenging for Kelly (3:1), balanced for Lola (6:6), and more frequently successful for Rachel (3:5). However, this variation was not always the case as Teacher Student Rapport was only talked about successfully by Lola and Rachel, and Motivation was nearly always challenging for Kelly and Lola. Overall, the most common topics participants talked about varied as to if they were successful or challenging. The only exceptions to this were Teacher Student Rapport and Motivation as noted.

Discussion

Newer teachers encountered both challenges and successes in their experiences and topics they spoke about. A common theme with the two most frequently talked about topics (i.e., Classroom Management, Engagement) was the focus of exerting control and compliance on student behavior, which agrees with previous research findings (e.g., Hover & Yeager, 2004). Although teachers can influence someone's behavior, they cannot directly control it. One

question we wondered about was how newer teachers view the distinction between the authority they hold as a teacher versus their locus of control as a human. To what extent do they recognize the boundary between direct control versus influence when working with students? Also, how does a newer teacher learn to flexibly contextualize their classroom management decisions from a novice to an advanced beginner (Berliner, 2004)?

Some of the topics the year three teachers spoke about were explicitly incorporated into their preparation program (e.g., interpreting and making sense of student thinking, differentiation) and identified in a common vision for teacher preparation (e.g., AMTE, 2019).The way and extent to which teacher preparation influences newer teacher's practice and decision making is based on the classroom settings, school structures related to mentoring, and their goals and visions for teaching (Hammerness, 2003; Jansen et al., 2018) as well as their development as a newer teacher (Berliner, 2004). Similar to contextualized teacher knowledge identified by Feldman and Herman (2015), this would help to explain why participants did not always talk about the same topics, nor why they experienced the same kinds of successes or challenges with them. The relevancy of a topic to each newer teacher depended upon their situational context, which also agrees with Leatham (2006) who concluded that practice is shaped by context.

Given the influence of varying school contexts beginning teachers will work within, we wondered how and to what extent this might be accounted for in teacher preparation. Moreover, given the evolution of newer teachers during the first few years of their careers, are teacher preparation programs designed to primarily serve teachers through their induction phase, or the phase after they become established classroom teachers? Although the vision provided in standards documents (e.g., AMTE, 2019) identifies what a well-prepared newer teacher should know, we wondered to what extent these components are pragmatic given the variation in teacher preparation programs and development that newer teachers experience.

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