The Development of Preservice Teachers' Visions of Mathematics Instruction

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Abstract

This study followed 18 preservice elementary teachers from the beginning of their professional studies courses (beginning of junior year) of their STEM-focused teacher preparation program to the end of the senior year. Specifically, the goal of the study was to examine how their visions of the role of the teacher during mathematics instruction evolved. Data was collected at three time points through interviews with the participants. Qualitative content analysis of the transcribed interviews was conducted using an existing framework for visions of high-quality mathematics instruction (Munter, 2014). Results indicated that two-thirds of the participants progressed from beginning to end of program in their visions of mathematics instruction that were more aligned with standards-based mathematics teaching. However, the participants varied as to how much change took place from the beginning to midpoint and how much change took place from the midpoint to the end. Possible explanations for the changes are presented.

Experts in the field of teacher education have indicated the need for rigorous, well-designed, longitudinal studies of teacher preparation programs (e.g., Cochran-Smith & Zeichner, 2010). More recently, colleges of education have been under fire for their work in preparing the next generation of teachers with more attention to evaluating and ranking the effectiveness of teacher preparation programs (Greenberg, McKee, & Wash, 2013). This increased scrutiny requires that teacher preparation programs carefully analyze and evaluate program outcomes, which is the very work of the current study. Examinations of how teachers develop on various constructs can provide implications for teacher educators in preparing the next generation of teachers. Nestled within a large longitudinal study of how elementary teachers develop on knowledge, beliefs, and practice, the current study focused on the following question: How do preservice teachers' visions of the teacher's role in mathematics instruction evolve over the course of their teacher preparation program?

Teachers' visions, as outlined by Hammerness (2001) are "a set of images of ideal classroom practice" (p. 143). Studying teachers' visions is timely with the recent release of NCTM's *Principles to Actions* (National Council of Teachers of Mathematics, 2014). A large chunk of this book is devoted to "Mathematics Teaching Practices," and for each practice, the book outlines the role of the teacher and students. With preservice teachers, it is critical that we better understand the development of their visions in comparison to the practices and role descriptions in *Principles to Actions* so that we can further refine teacher preparation programs. While there has been work on practicing teachers' development of visions (e.g. (Hammerness, 2008; Munter, 2014), this study fills a gap by focusing on *preservice teachers* (PSTs) and is particularly fitting for this population since "visions" implies a view of their future work as teachers. Further, the aforementioned prior work (Hammerness, 2008; Munter, 2014) focused on

middle and high school teachers, and the current work is focused on PSTs at the *elementary* level.

Theoretical Framework

The current study draws on the framework proposed by Hammerness (2001) on teachers' visions and on more recent work by Munter (2014). Through her work, Hammerness (2001) noted that teachers' visions tend to vary across focus (what are the areas of focus), range (how narrow or broad is the focus), and distance (how far or close the vision is to practice). The current study examines the first of these constructs – on what the preservice teachers *focus* as they describe their visions of ideal mathematics instructional practices.

Drawing on standards-based practices in the mathematics education literature, Munter (2014) developed a framework for examining the role of the teacher on five progressively sophisticated levels: motivator, deliverer of knowledge, monitor, facilitator, and more knowledgeable other. As one moves up the levels in the framework, the descriptors for the role of the teacher are more aligned with a vision of standards-based teaching practices as advocated by NCTM (2014; 2000) and in the Standards for Mathematical Practice (SMPs) in the Common Core State Standards for Mathematics (CCSS-M) (National Governors Association Center for Best Practices and the Council of Chief State School Officers, 2010). At the first level of motivator, the primary role of the teacher is to entertain, to make learning fun, and/or to make emotional connections with students. The second level, teacher as deliverer of knowledge, indicates the role of the teacher is responsible for the delivering the mathematical knowledge accurately and clearly, in a direct way. When students practice what the teacher has taught them, it is usually done individually. Teacher as monitor is the third level on Munter's rubric. If the teacher is a monitor, his/her role involves providing demonstration on how to do a certain type of

mathematical task but then giving students time to work and talk together on the focus topic. As the teacher monitors the work, the teacher redirects students if they are moving down an incorrect or nonproductive solution path. The fourth level, teacher as facilitator, typically involves a teacher launching a mathematical task, students working in groups to figure it out, and the entire class discussing their strategies. If students are pursuing an incorrect solution method, the teacher asks probing questions to help them in their thinking, but the teacher does not directly tell the students what to do. Finally, when a teacher is described as a more knowledgeable other (the fifth level), the teacher and students share the mathematical authority, and the entire community of learners constructs the knowledge together. That is, the teacher is not the sole source of knowledge; the students and teacher work together toward a shared mathematical goal (Munter, 2014).

Method

Participants

The participants in this study were 18 elementary education preservice teachers during their two full-time years in the teacher education program (junior and senior years). All participants were traditional undergraduate students who had entered post-secondary studies immediately after high school; therefore, all participants were approximately 20-22 years old at the three time points of data collection (beginning of junior year/full-time program, end of junior year/midway through program, and end of senior year/program). 17 of the 18 participants were female. Fifty-five preservice teachers were eligible to participate, 30 volunteered, and 18 of the 30 were selected using stratified sampling based on select variables (e.g., SAT). In this report, pseudonyms are used for all participants.

Context

The 18 participating PSTs were students in a STEM-focused elementary teacher preparation program. During their freshman and sophomore years, PSTs in the program engage in their general studies courses which include four math courses (including C*alculus for Elementary Teachers*), four science courses (including *Physics for Elementary Teachers*), one engineering design course, and an *Introduction to Elementary Education* course. During their junior and senior years, PSTs complete three full-time semesters of elementary education coursework accompanied with field experiences and one final semester of full-time student teaching in a classroom where they are placed the entire academic year. Among the multitude of methods coursework, the PSTs take two mathematics methods courses (K-2 and 3-5), two science methods courses (K-2 and 3-5), and one engineering methods course. The four semesters of field experiences total 818 hours (86, 86, 121, 525). McIntyre et al. (2013) outlines more details about the teacher preparation program.

Data Collection

For the larger study, they completed assessments and surveys as well as participated in 13 interviews over two years. The focus of the current study was their responses to two questions in three of those interviews (beginning of program, midway, end of program). The two questions asked at the multiple time points were: (1) *Describe a math lesson in an elementary school classroom that you would consider to be effective and explain why you consider it to be effective*; and (2) *What the teacher does and what the students are doing during mathematics instruction are really important. Describe what you think the teacher should be doing most of the time, and describe what you think the students should be doing most of the time.* Additionally, there was a third question in the beginning of the program interview that was included in the analysis because all participants responded to the question with a description of a school-based

experience in a mathematics classroom: *Consider your own experiences learning mathematics at any time in your life. Describe a learning experience in mathematics that was particularly effective for you. What made it effective?* All interviews were transcribed before analysis.

Measure

To code the participants' responses to the above questions, one rubric (Role of the Teacher) from the Visions of High-Quality Mathematics Instruction (VHQMI) instrument (Munter, 2014) was used. The rubric includes five levels (Levels 0-4) that correspond to how the participant described the role of the teacher, as described earlier.

Analysis

Qualitative content analysis (Schreier, 2012) was used to determine how the PSTs' visions of mathematics instruction evolved. The transcribed interview responses to the selected questions were coded by at least two coders, and two of the 18 cases were coded by all three coders. Each idea within a participant's responses to the interview questions for a time point was coded, but an overall code for a given time point was assigned based upon the highest code used within a participant's response. All coders also recorded a written rationale for the assigned code. Within-one agreement among coders was 98%, and exact-match agreement was 65%. The three coders met to discuss all discrepancies and reached consensus on final codes.

Findings

Overall, findings indicated that the PSTs progressed in their visions of mathematics instruction from the time they entered the program until they graduated. Table 1 displays the data by time point and the number of participants at each level. Two levels have greater changes from the beginning to the end. By the end of the program and in comparison to the beginning,

there are less PSTs at Level 1 (Teacher as Deliverer of Knowledge) and more PSTs at Level 3 (Teacher as Facilitator).

Table 1: Data by Time Point – Number of Participants at Each Level

	Beginning of Program	Midpoint of Program	End of Program
Level 0 *Teacher as Motivator*	1	0	0
Level 1 *Teacher as Deliverer of Knowledge*	8	1	2
Level 2 *Teacher as Monitor*	8	10	9
Level 3 *Teacher as Facilitator*	1	6	6
Level 4 *Teacher as More Knowledgeable Other*	0	1	1

Table 1 presents a holistic look at the results, but it is important to provide a finer-grained description of the trajectories over time for the PSTs. To make sense of these trajectories, we present our findings in three groups: (1) those whose score on the VHQMI rubric is higher at program exit than entry (n = 12); (2) those whose score is the same at program exit as it was at entry (n = 4); and (3) those whose score is lower at program exit than entry (n = 2). Table 2 displays the results for each participant. As indicated in the table, we refer to the scores at each time point with the following three terms: beginning-of-program score (BOP), midpoint-of-program score (MOP), and end-of-program score (EOP).

Table 2: Results by Participant and Group

Participant	*Beginning of Program (BOP)*	*Midpoint of Program (MOP)*	*End of Program (EOP)*
Group #1: EOP score higher than BOP score			
Frances	2	3	4
Michelle	0	1	3
Stephanie	1	2	3
Shelly	1	2	3
Caroline	1	2	2
Nora	1	2	2
Olivia	1	2	2
Amelia	2	3	3
Tina	2	2	3
Gretchen	1	3	2
Tiffany	1	3	2
Pamela	2	4	3
Group #2: EOP score equal to BOP score			
Christina	2	2	2
Gabriella	2	2	2
Lisa	2	2	2
Renee	1	2	1
Group #3: EOP score less than BOP score			
Patrick	3	3	2
Tori	2	3	1

Group #1: EOP score higher than BOP score

The first group, comprised of most of the preservice teachers (n = 12), moved forward in their vision of high-quality mathematics instruction. That is, from the point of program entry to program exit, they moved toward a vision of mathematics instruction that is more standards-based. For this group of twelve people, there were three sub-groups that emerged. We describe each of those sub-groups below by providing illustrative examples.

Subgroup #1. The first subgroup of Group #1 (n=4) includes those who showed progression across the three time points as shown in Table 1 (Frances, Michelle, Stephanie, and Shelly). Their scores on the VHQMI rubric increased from beginning to midpoint to end. We provide an illustration of one of the participants in this subgroup who we call Shelly. Shelly progresses from envisioning the teacher as a deliver of knowledge, to a monitor, to a facilitator.

At the beginning of her Junior Year, Shelly described effective mathematics instruction as teacher-centered and focused on transmitting knowledge from the teacher to the students. She stated:

> I feel like the teacher should be giving examples of what she is doing like writing out examples...I feel like that is an effective way to get show them what is going on and then like as you do the lesson you explain what you are doing and so that they know what the process is and how they are supposed to do it (Introduction to Junior Year Interview).

Shelly emphasized that the teacher needs to show the process or procedure, and in response, students should take notes and memorize the procedures. She also stated, "Then with the students I feel like they should like be writing down the examples and so they can reference them" (Introduction to Junior Year Interview). The student's role is to practice and use the procedures

learned, which is further evident as Shelly shared about her experiences with learning her multiplication facts. She shared:

> We had a test every week on your multiplication tables and if you like got them all right then you were done, you never had to take it again and like I know that was effective because you wanted to know them all the first time so that you didn't have to take it anymore, you wanted to be done with that test (Introduction to Junior Year Interview).

Shelly's recollection of a childhood learning experience that she considered effective supports the idea that Shelly saw the teacher as a deliverer of knowledge when she began the program.

After her methods courses, Shelly maintained an emphasis on the direct instruction from the teacher, but she attended more to students' understanding and mentioned that students should have opportunities to explore mathematical ideas (teacher as monitor). Shelly said:

> ...the teacher would first off let the students kind of explore an idea, like for example like if they were learning a new topic, like have them explore what they think they should do maybe and then allow them time to do that and then pull them in and like guide them towards the best way to go about finding the answer or doing the problem and then to make sure they really understand the concepts behind the math, not just know how to do it but really understand why they're doing it and the purpose of it (End of Junior Year Interview).

Although this idea of student exploration is not held consistent within all of Shelly's thoughts (e.g., "The teacher should be *showing* them why they're doing it and *giving them examples* and then making sure that they really understand the concepts behind what they're doing" [italics added for emphasis, End of Junior Year interview]), Shelly shows evidence of valuing student co-creation of knowledge.

At the end of Senior Year, Shelly's view of effective instruction was more focused on student involvement in the learning process. Shelly shared:

> I think that an effective math lesson has the teacher, although she does do a little bit of direct instruction so that she can introduce the concept and kind of help the students understand the basics but also she allows the students to talk to each other together to try to figure things out…. I feel like the teacher is more like a facilitator so she's there to help the students...talk to each other so like she would ask a question like, 'Take me to through this answer'...You're helping to have that discourse and believe that discourse with the students (End of Senior Year interview).

Here Shelly provides a specific prompt that she would use to solicit student explanation and acknowledges the importance of student-to-student exchanges as they build their understanding.

Subgroup #2. The second subgroup of Group #1 (n=5) includes participants who progressed from entry to program exit; however, they remained at the same level either after methods or after student teaching (see Table 2). We present one case, Caroline, as an illustrative example of this type of move on the trajectory. Caroline shifts from seeing the teacher as the deliverer of knowledge to the role of monitor after her methods courses and maintains this vision at the conclusion of her student teacher placement.

Initially, Caroline refers to her vision of an effective lesson by stating,

> Well I would want it to like have a good introduction to it...and then I would want them [students] to like slowly I guess be brought into it like we work on it together. I guess the teacher would show them how to do it, then they could like do it themselves with the teacher's help and then they could work on it on their own I guess and then you would

> give them feedback based on what they did on their own (Introduction to Junior Year Interview).

She again emphasizes the need for the teacher to explicitly walk student through how to do the mathematics in her statement, "They [students] are not gonna know how to do it right after just seeing you do it so to work with them and kind of show them together."

After her methods coursework, Caroline's description of effective instruction continued to emphasize the importance of direct instruction from teacher but included opportunities for students to work together, elevating her vision of the teacher to one of monitor. She shared:

> When I taught my lesson...I was able to show them examples and then I, they were able to work by themselves and then I was able to like go to each student because it was the small groups and like work with them and then they were able to talk to each other, so I like it, like a lesson with a lot of discourse in it is a lesson that I feel like is a good math lesson"(End of Junior Year Interview).

This added value of small-group work is twofold; small-group work allows students to help each other and allows the teacher time to touch base with students as well.

Caroline maintained her view of the teacher as a monitor after her student teaching internship. She commented that:

> I think the most effective class would be starting and kind of introduce the topic, then kind of like...give an idea of how maybe the students are taking information and then after like working together as a group for a little bit, maybe split up in kind of different groups so that you can really narrow in on some of the kids, what they really need, what they need to further (End of Senior Year).

The format of an effective lesson remained the same with direct instruction, guided practice, and then opportunities for students to work together to practice the target skill or idea.

Subgroup #3. The third subgroup of Group #1 (n=3) includes participants who progressed from entry to post-methods but then regress after student teaching; however, they are still at a higher level at program exit than entry. We present one case, Gretchen, as an illustrative example of this type of move on the trajectory. Gretchen shifted from seeing the teacher as the deliverer of knowledge to the role of facilitator, but then at program exit, she sees the teacher as a monitor.

Prior to her methods courses, Gretchen saw the role of teacher as a deliverer of knowledge. Gretchen shared:

> Probably the teacher's job should be more as explaining the lesson, seeing if the student is following, do they have any questions. Giving them a chance to come up and do examples to keep them engaged, to keep their attention on the lesson and also maybe after he or she has done the lesson giving them practice by themselves (Introduction to Junior Year Interview).

She described a traditional lesson with direct instruction, guided practice, and independent practice.

After methods coursework Gretchen leaps forward in her conception of the role of the teacher to more of a facilitator of student discovery of knowledge. Gretchen reflected on a lesson she taught in a fifth grade classroom.

> The most effective part was allowing them to manipulate those cubes and discover for themselves and we learned that that's the most effective process where you just don't tell students but you allow them to learn for themselves and discover things on their own. Because it'd be better for them to comprehend and keep it, keep it in their head. So after

> we let them manipulate the cubes, we talked about it and we talked about, you know, how volume was calculated with those cubes. (End of Junior Year Interview).

Gretchen no longer positioned the teacher as the sole bearer of information, but instead saw the teacher as using student ideas and contributions to guide the lesson toward the goal of the lesson.

After her student teaching, Gretchen describes an effective lesson revolving around math centers in which she leads a small group. She describes,

> I'm going through the mini lesson, I'm asking questions so that students can answer them and I'm taking mental notes and trying to see alright, do I need to explain it in a different way. I'm going over key vocabulary words and I really want them to remember and I'm making that anchor chart so that they can refer back to it. Then I am letting them do some practice… practice problems and so once they're doing practice problems, they might be able to collaborate with each other, and I am walking around taking more anecdotal records to see what else do I need to teach them and after that, then that's the end of the small group work.

In Gretchen's response, she no longer included student exploration, but instead repositioned the teacher as initially providing the students with direct instruction on a mathematics topic. She continued to value student collaboration which is evident in her use of centers and the opportunity she provided for them to complete the practice problems together.

Group #2: EOP score equal to BOP score

The PSTs in Group #2 (n = 4) remained steady on their vision of high-quality mathematics teaching (see Table 2). That is, they had the same score on the VHQMI teacher role rubric at the beginning and end of the program (Christina, Gabriella, Lisa, and Renee). Three of these four participants maintained the same score on the rubric from the beginning to

midway to the end of program, describing the teacher as a monitor. We use Gabriella as an illustrative example of a participant who demonstrated this trajectory of maintaining her vision of the role of the teacher as monitor.

Before Gabriella began her methods courses she viewed the teacher's role as one of a monitor. She felt that "teachers should be giving examples [and] walking around and helping"; however, students should also be grouped together so that "the kids will be able to help each other." Gabriella saw the teacher as the source of knowledge but also as monitor as the students worked together.

Upon completion of her methods courses, Gabriella still felt that the teacher's role was one of a monitor. During her review of a previous lesson, Gabriella felt it was effective because "it [was] short, [and] because it wasn't just [her] talking the whole time, they got to talk to their classmates… and work in partner groups". She not only felt that this was effective, but she also felt that most lessons in school should be taught this way. Gabriella stated:

> So much of school is being silent and it's so hard for kids to be silent all the time. And so, just like giving them that extra 2 to 3 minutes to talk, even if it's about math, they're just like so much happier and they function so much better (End of Junior Year interview).

Gabriella still believed the students acquire knowledge from the teacher, and she emphasized t he importance of students talking to each other.

Finally, at the end of Gabriella's student teaching, she felt the teacher should still be functioning as a monitor in the classroom. From her interview, Gabriella speaks of another effective lesson as one where,

> Kids need to talk about math. They need to figure out not just like what I'm saying, but they need to figure out with their partners. Cause, kid to kid discourse is so much easier for them to figure out sometimes; just because it's on their level.

Gabriella still valued student-to-student discourse; however, she also valued the role of the teacher monitoring the classroom as well. Gabriella discussed her math lesson as one in which she was "pulling kids up to the front of the room… that way I know those kids, everybody's paying attention. They're trying to behave so they, they get to be the one chosen to go up to the front of the room". She struggled with wanting to maintain control for the sake of classroom management but also allowing the students to discuss ideas on her own. This struggle kept Gabriella from moving into viewing effective teaching as one in which the teacher is a facilitator.

One participant in Group #2, Renee, did not remain the same in vision of high-quality mathematics teaching. Instead, Renee moved forward after methods courses on the trajectory, but then, moved back after student teaching, describing the role of the teacher as deliverer of knowledge at the end of the program. Before beginning her methods courses, Renee viewed the role of the teacher as a deliverer of knowledge. In mentioning what the teacher should be doing during a math lesson, Renee felt that the "teacher should have a good example for [the students]" and should "watch them and make sure that they're on the right track". In terms of what the students should be doing, she felt as though they should have a lot of practice and repetition in order to learn a concept well and did not make mention of any student-to-student discourse.

After her methods courses, Renee grew in her vision of the role the teacher to one of 'teacher as monitor'. Renee mentions, "I think that the kids should be listening to the teacher but also... talking with each other during math lesson". She feels that allowing students to explore a concept with minimal help from the teacher can "be really effective for them learning and also

just getting to do something with their hands would keep them more engaged than just staring at the teacher or listening to them talk".

Upon completion of her student teaching, Renee moved back into thinking that the teacher should be a deliverer of knowledge versus a monitor. Red mentioned that:

> I think that for me, as a teacher, it is like productive for me to have at least ten minutes of lecture at the beginning, like where I model. So, I would say for the first part of the class, like the teacher should model so that [the students] have some background knowledge and they're refreshed. And then I think that you should do guided practice.

At this final time point, Renee valued a teacher-centered classroom and more traditional lessons with little student-to-student discourse.

Group #3: EOP score less than BOP score

The last group of participants (n=2) included those that belonged to Group #3 (Patrick, Tori). These participants regressed on their vision of high-quality mathematics teaching from when they started the teacher education program to post-student teaching (see Table 2). We present the stories of Patrick and Tori to give a sense of each of their trajectories.

Patrick was the only participant who began the program with a vision of role of the teacher as a facilitator (Level 3). In fact, this was the highest beginning-of-program score among all participants. In his beginning interview, Patrick mentions that students should be working in groups and "talking or collaborating". He also mentions that students should "drive their learning [and] take responsibility for it" as well as be "actively engaged". Additionally, the teacher should be "facilitating discussions so that it doesn't get out of hand" and "helping students if… students are having trouble".

After the completion of his methods courses, Patrick still feels that the teacher should be a facilitator. For example, his beliefs that students should be engaged in "small group discussions" as well as gaining "a more conceptual idea of what actually is going on" is all consistent with the role of teacher as facilitator. Patrick uses a metaphor to better explain his view of the teacher as a facilitator,

> If you imagine that [the students] are lining up at a racetrack and they're about to get started, so the teacher gives them the, the tennis shoes they need and like the sweatbands and everything that they need for a race and then just allows them to go and then as they start getting off course the teacher is there as the facilitator getting them back on course, not exactly getting them all the way to the end but allowing them to continue on that right path so that they eventually get to that answer on their own (End of Junior Year interview).

This metaphor shows how Patrick views himself as less of an "information giver and more of the facilitator" after completion of his methods coursework.

However, after completing student teaching, Patrick's views change to one in which the teacher is more of a monitor than a facilitator. Patrick feels as though a teacher as 'facilitator' is just a "buzz word people look for". Although he considers a classroom to be effective when students are working in centers and the teacher is there for guidance, he also feels that "as much as people like berate, you know, standing in front of the class, there is time for that". This change in feelings leads Patrick to view a teacher as a monitor rather than a facilitator.

The second PST in Group #3 is Tori. Tori began the program envisioning the teacher as a monitor, after the methods courses, she viewed the teacher with a more sophisticated view as a facilitator. However, after her student teaching experiences, Tori regressed back to a view of the

teacher as a deliverer of knowledge. At the beginning of coursework, Tori described the importance of the practice portion of a lesson, and when probed Tori shared that student should practice, "By group discussions...maybe they can work together on it and use their thinking processes and critical thinking to come together and all come to a conclusion or maybe they have to work it out themselves." In terms of the teacher's role Tori stated, "For the most part, I think the teacher should be making sure that they're...doing it accurately, and helping them to explain if not why, why's that not right." These descriptions portray the teacher as a monitor of students' work and thinking to ensure that all students are mastering the tasks the teacher puts before them.

After her methods courses, Tori perceived effective instruction as students engaging in more than just practice, describing students actively involved in creating understanding through their interactions. She stated:

> I think that during math time, it's more effective if students are working together...They really work together...and they're able to really help each other and guide each other...Everyone has different perceptions of things and it's really neat to see how that's thrown into a group of differentiated students. (End of Junior Year Interview)

In terms of the teacher, Tori described the teacher's role as a facilitator stating, "Teachers should be asking deeper questions not just what is your answer...how do you get this... what does this mean...there should always be connections, and just probing for deeper thinking."

Tori's progression in her vision of effective teaching reversed after her student teaching to a view of the teacher as a transmitter of knowledge. She no longer viewed student collaboration as essential to instruction but instead expressed' a view that the teacher needed to use direct instruction to deliver "hard concepts." This view is evident in Tori's response in that:

> If you know that it's a really hard concept and the kids are really struggling with it, it's not always good to put them in group work. Not every child is able to do group work effectively, so you have to accommodate for those kids. (End of Senior Year interview)

Here, Tori demonstrated less value for students working together in groups.

Discussion

Overall, the participants in this study showed progress in their vision of the role of the teacher in mathematics instruction. This type of progress is consistent with other work done that included an intervention (Munter, 2014). Two-thirds, or twelve, of the participants ended the program with a higher score on the VHQMI rubric than they had at the beginning of the program. This finding indicates that components of the teacher education program had an influence on how they envisioned mathematics teaching. Since the goals of the program include an emphasis on standards-based mathematics teaching, this finding is not surprising. In their methods coursework, there is an emphasis on the use of cognitively demanding tasks, mathematical representations, and discourse. An inquiry-oriented to instruction is emphasized.

It is important to further unpack the trajectories for which we provided illustrative examples. We presented three groups based upon whether their VHQMI scores increased, stayed the same, or decreased from program entry to exit. Within each of those groups, there was some variability in terms of what happened at the midway point. Therefore, we try to explain this variability by zooming in on the changes that we described from one time point to the next.

First, we comment on the progression of PSTs from the beginning to midway in the program. Across all 18 participants, 13 of them articulated more sophisticated visions of mathematics instruction at the midway point than they did at the beginning of the program. The

remaining five participants maintained the same score. The increase in scores for 13 of the participants can likely be explained by the methods coursework. The participants experienced two mathematics methods courses in the fall and spring of their junior year. The midpoint interview took place near the same time that the PSTs finished their second mathematics methods course. It makes sense that many of them articulated more standards-based visions of the role of the teacher in mathematics instruction. While five participants did not change, all of them entered the program with a Level 2 or 3 (monitor or facilitator) score. Perhaps, no change should be expected with less room for improvement than students who entered with a Level 0 or 1 score.

Second, we focus on the changes from the midway point to the end of the senior year. The scores changed in the following ways: 5 PSTs' scores increased; 7 PSTs' scores stayed the same; and 6 PSTs' scores decreased. It is definitely interesting that 13 PSTs either stayed the same or decreased how their visions of the role of the teacher aligned with standards-based mathematics teaching. Clearly, this speaks to the role of the field placement during the senior year. The student teaching placement is year-long (part-time in fall and full-time in spring), and the program has a School Partnership Coordinator who carefully monitors the quality of the placements. However, perhaps in some cases, there is misalignment between teaching practices of the mentor teacher and what is advocated in the methods courses. An alternate, and perhaps more plausible explanation, is that the student teachers are faced with so many challenges as a novice teacher (e.g., classroom management) that their visions of what is feasible as a mathematics teacher either remains the same or changes to less standards-based. The needs of novice teachers are unique and particularly when still a PST.

This study is just the first step in exploring and investigating how PSTs change over time in their visions of the role of the teacher during mathematics instruction. Our next steps include trying to better understand why certain candidates move along the trajectory in certain ways. We have additional interview data to attempt to make sense of the various trajectories. Additionally, we are currently following 16 of the participants in their first year of teaching. Part of this work includes understanding how their visions evolve as they enter the profession and deal with the numerous challenges that the first year of teaching presents. By understanding PSTs' and early career teachers' visions of mathematics instruction, we seek to inform the work of mathematics teacher educators.

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