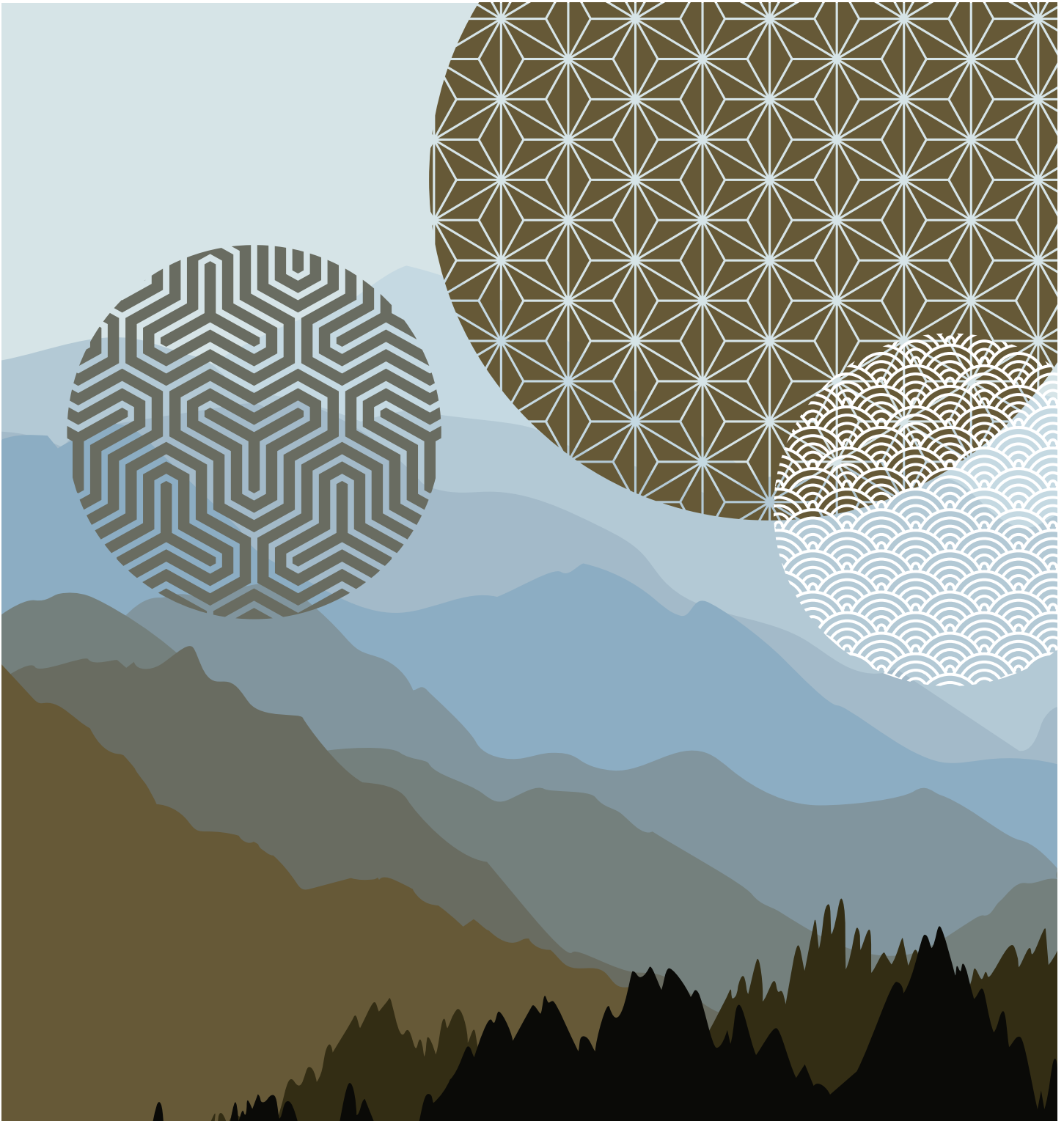


# ***NCSM Journal***

*of Mathematics Education Leadership*

FALL/WINTER 2021-2022

VOL. 22, NO. 2



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## Leadership from Within the Classroom: Opportunities and Challenges for Elementary Mathematics Specialists

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### *Abstract*

*In this article, we describe the leadership opportunities and challenges experienced by eight Elementary Mathematics Specialists (EMS) who had all remained in their primary role as classroom teachers after obtaining their specialist certificates. Drawing on Gigante and Firestone (2008), we categorize the EMS' leadership tasks in terms of whether they supported colleagues in increasing their knowledge of teaching mathematics. After describing the leadership tasks and how they came about, we describe four challenges at least some participants faced in enacting leadership from their classroom teaching roles. We conclude with recommendations for ways different stakeholders can support EMS in taking on leadership tasks while remaining full time classroom teachers.*

### *Introduction*

**E**ffective mathematics teaching at the elementary level requires specialized content knowledge and expertise that teachers do not often develop in their relatively limited undergraduate coursework (e.g., Ball, 2017; Wu, 2009). As a result, school and district

leaders must find innovative strategies for supporting elementary teachers to continue to develop their pedagogical and specialized content knowledge over time. One way schools have addressed this need is through the hiring of teacher leaders, such as mathematics coaches or specialists, who can provide sustained professional development to teachers within a school or district (e.g., Ellington et al., 2017; McGatha et al., 2015). There is evidence that the use of full-time mathematics coaches/specialists can have a positive impact on student achievement (Harbour & Saclarides, 2020); however, this approach is cost-intensive and requires removing a teacher from the classroom. An alternative approach is to utilize teachers who have similar content-level expertise as mathematics coaches/specialists and are interested in engaging in leadership in addition to fulfilling their responsibilities as a classroom teacher. While prior research has studied the leadership tasks and challenges experienced by mathematics coaches serving in formal leadership roles (e.g., Campbell & Griffin, 2017), little is known about the leadership experiences of those who remain in the classroom full time.

In this paper, we describe the leadership experiences of eight 3rd – 5th grade public school teachers in their first year after completing an Elementary Mathematics Specialist (EMS) program, which aimed to strengthen teachers' pedagogical and specialized content knowledge through the lens of teacher leadership. Through focusing

specifically on the leadership experiences of EMS classroom teachers, we aim to raise awareness about the potential role they can have in their school contexts, particularly in terms of increasing their colleagues' knowledge for teaching mathematics. Based on the teachers' experiences and challenges in enacting leadership tasks, we conclude by describing ways that different stakeholders (district and school leaders, mathematics coaches, teacher leaders, and EMS programs) can support EMS to successfully engage in meaningful mathematics leadership while remaining in the classroom. By focusing on the perspective of eight EMS classroom teachers, we shed light on an under-researched group of teacher leaders whose experiences can serve to motivate future research.

### Elementary Mathematics Specialists

EMS programs situate the study of mathematics content and pedagogy within a framework of mathematics leadership with the goal of impacting not only the teaching of graduates but also the schools and districts in which they work (Association of Mathematics Teacher Educators, 2013). Courses dedicated to developing leadership capacity provide opportunities to interpret state assessment data, work with administrators, lead professional development opportunities, design community outreach programs, and analyze curriculum resources. Because of these experiences, EMS professionals are uniquely poised to take on a variety of leadership roles, such as specialized mathematics teaching assignments, coaching and mentoring, curriculum leadership, and community outreach (de Araujo et al., 2017). Studies have found that EMS programs have a positive impact on both knowledge and beliefs of participating teachers (Campbell & Malkus, 2014; Gibbons, 2017; Swars et al., 2018; Webel et al., 2018). The use of this expertise in school settings has been most often studied in terms of formal leadership roles, like math coaches, who support teachers to improve their math instruction (Gibbons, 2017; Hubbard & Livy, 2021). Our work adds to this literature by exploring the leadership experiences of EMS who are full-time classroom teachers, sometimes in "departmentalized" roles where they teach mathematics to multiple classes of students (see Markworth, 2017; Webel et al., 2017).

### Teacher Leadership

Drawing upon York-Barr and Duke (2004), we define teacher leadership broadly as individual or collective teacher actions that "influence colleagues, principals, and other members of school communities to improve teaching and learning practices with the aim of increased student learn-

ing and achievement" (p. 288). When defining the work of teacher leadership, a distinction is often made between formal role assignments and informal work that emerges more organically. This can be an important differentiation for teachers who are trying to establish their legitimacy as a teacher leader (Berg & Zoellick, 2019) and receive recognition for their own agency in improving student learning and achievement (Muijs & Harris, 2007; Sinha et al., 2012; Wenner & Campbell, 2018; York-Barr & Duke, 2004). *Formal leadership* is generally defined as those acts connected to a role formally recognized by an administrative leader in the building, such as serving on a committee or facilitating a professional development session. Informal leadership includes acts not directly connected to a role assigned by an administrator, such as helping a colleague plan a lesson or implement a new math routine. It is common to recognize leadership tasks performed by those who hold formal positions; however, teacher leaders can also play a significant role in enacting change at their school informally by, for example, presenting at faculty meetings, providing input during the decision-making process, and disseminating information (Whitaker, 1995). While designating leadership acts as formal or informal can be useful when describing the range of leadership that can occur, Berg and Zoellick (2019) caution that this distinction alone provides a superficial perspective on teacher leadership that is insufficient for the continued development of the field.

One way to add nuance to studies around teacher leadership is through evaluating the extent to which different leadership tasks have the potential to increase others' knowledge of teaching (Gigante & Firestone, 2008). These tasks, which are referred to as *developmental tasks*, include designing lessons, answering questions about mathematics teaching and learning, and facilitating professional development. In contrast, support tasks are those that support teachers' work without necessarily increasing their knowledge by, for such as managing materials, establishing pacing guidelines, or piloting curriculum. Evaluating leadership tasks through this lens can provide insight into the value they provide others. Specifically, while support tasks can make the work of teaching easier, developmental leadership tasks deepen teacher knowledge, an important factor for improving instructional practice (Darling-Hammond et al., 2009). Though Gigante and Firestone (2008) argue that teacher leaders should engage in developmental leadership tasks with the goal of deepening their colleagues' knowledge and skills in effective instructional practices, researchers have found that instructional coaches

often spend large portions of their time instead on support tasks (Kane & Rosenquist, 2019; Knight, 2012). That said, teacher leaders are more likely to engage in developmental tasks when they have access to four resources: time to interact with colleagues; positive relationships with colleagues; opportunities to work on professional development; and administrative support and reinforcement of the teacher leader role (Gigante & Firestone, 2008).

Teacher leaders will likely encounter many challenges engaging in leadership tasks if there is not ongoing work at the school and district level to maintain a culture that acknowledges their legitimacy (York-Barr & Duke, 2004; Wenner & Campbell, 2017). While legitimacy can come from an assigned formal role or position, it can also emerge from recognition of the teacher leader's specialized knowledge and skill (Berg & Zoellick, 2019; Diamond & Spillane, 2016). Principals, in particular, can validate legitimacy by recognizing teacher leaders' expertise, and clearly communicating their roles and responsibilities for leadership (Smith et al., 2017; Wenner & Campbell, 2017). In mathematics, however, researchers have found that administrators may be less likely to view the people in their own buildings as a primary source for instructional leadership (Burch & Spillane, 2003; Spillane & Hopkins, 2013) and teachers more likely to seek support for mathematics instruction from formal leaders with math-specific positions than those without (Spillane & Kim, 2012; Spillane & Hopkins, 2013). On the other hand, there is promising evidence that a positive shift in productive collaboration can occur when more formal leadership is assigned to teachers recognized for their mathematics instructional expertise (Diamond & Spillane, 2016). Beyond challenges related to legitimacy, researchers have also acknowledged the constraining force of a lack of time and opportunities for leadership (Berg & Zoellick, 2019; Markworth, 2017; Wenner & Campbell, 2017; York-Barr & Duke, 2004). This challenge might be particularly pertinent for teacher leaders with full time classroom responsibilities as they are unlikely to have release time for leadership activities, especially ones that fall outside of their regular duties (Smith et al., 2017). While the range of challenges we have described have been applied in prior literature to teacher leaders generally—both with and without formal leadership roles—we suggest that they may be especially salient for those that continue as classroom teachers. Thus, the leadership challenges of teacher leaders with full time classroom responsibilities warrants attention, and our study explores this area.

The research questions guiding our work were:

1. What was the nature of the formal and informal tasks EMS-certified teachers engaged in during the first year after they graduated from the program?
2. What challenges did the EMS-certified teachers face when engaging in leadership while serving as full time classroom teachers?

## *Methods*

We employed case study methodology (Yin, 2014) to investigate the experiences of EMS who remained in the classroom as 3rd through 5th grade teachers. Eight participants were selected as typical cases of elementary teaching assignments (Seawright & Gerring, 2008), with contextual variation between cases. Specifically, the teachers were typical or representative of the range of school size and demographics in our larger study and varied in terms of the types of curriculum used and whether the teachers were departmentalized (teaching mathematics to multiple groups of students) or self-contained (teaching all subjects to a single group of students). Table 1 (next page) provides background information on each of the case study teachers and their broader school contexts.

Case study participants completed a two-year program that was co-designed by faculty across five institutions and included 24 credits of graduate level coursework aligned with the AMTE Standards for Elementary Specialists (2013). The coursework led to EMS certification from the state department of education. The coalition of faculty continued to meet biannually to revise courses and discuss programmatic issues (recruitment, communications with state education administrators, etc.) for the next several years (Goodman et al., 2017). The courses themselves were blended, with online coursework combined with five face-to-face sessions each semester (20 total over the course of the program). There were five content courses, each focused on developing deep knowledge of elementary mathematics concepts, awareness of how children develop this knowledge, and engagement with the kinds of tasks, representations, and discourse that support mathematics learning. There were also two leadership courses, which addressed the history of mathematics education, the role of textbooks and curricular programs, general leadership, and specific mathematics leadership skills like coaching teachers, facilitating professional development, interpreting standardized testing data, co-teaching, conducting

Table 1: Background information about participants

Condition	Amy	Denise	Emma	Joni	Keri	Leah	Mary	Taylor
School Size	480 (K-4th)		450 (K-5th)	100 (K-5th)	650 (K-6th)	520 (3rd-5th)	450 (K-5th)	720 (PK-5th)
% FRL	100%		30%	35%	50%	65%	55%	30%
Math proficiency testing scores <sup>1</sup>	30%	45%	60%	70%	60%	45%	75%	50%
Grade Taught	3rd	4th	4th	5th	5th	4th	4th	5th
Years of Teaching Experience (at grade level)	9(4)	4(1)	4(3)	4(4)	4(1)	4(0)	4(3)	8(0)

Note: Demographic data was taken from the year they were interviewed. All numbers were rounded to preserve anonymity.

lesson studies, and negotiating duties with school administrators.

As a part of the broader study, we conducted five semi-structured interviews with each case study participant over the course of one school year, including two interviews that occurred after observing a math lesson. Two primary leadership questions we asked teachers during the interviews were “Do you feel like you have had opportunities to be a leader in your building or district? (This could be informal, like colleagues asking for math advice or the principal seeking input about a program),” and “If you have not had many leadership opportunities, are there any that you wish you had?” Data for this study included teachers’ responses to the two leadership questions above as well as any instance when the teachers discussed leadership opportunities they were involved in while responding to other interview prompts about their school year.

Our analysis process began by reading through the transcripts to identify the sections where the EMS discussed leadership tasks in which they were currently engaged or where they responded to specific interview prompts listed above. After identifying the leadership task each EMS engaged in, we coded them as either *formal* or *informal* based on whether the leadership task was formally recognized by administration or part of a formal structure or routine (York-Barr & Duke, 2004) to gain insights into how each of the leadership opportunities came about. Next, we classified each leadership task as being either *support* or *developmental* (Gigante & Firestone, 2008),

using the EMS’ description of the leadership activity to support this determination. For example, when a teacher described being on a leadership committee, we asked follow-up questions about the goals and tasks of the committee. Committees that looked at student strategies for math content across the grades with the goal of sharing the information with teachers was classified as *developmental*, whereas committees to select new curriculum or analyze testing data were considered *support* since they did not directly help teachers grow in their knowledge of how to teach mathematics. This second classification allowed us to distinguish between instances where the EMS could utilize their expertise to help their colleagues increase their knowledge of teaching elementary mathematics (*developmental*) versus those that were more administrative in nature (*support*).

After categorizing the types of leadership tasks each participant carried out during their first year as an EMS graduate, we analyzed the challenges they encountered while trying to engage in leadership tasks as full-time classroom teachers based on the ones found in the literature (issues around legitimacy, time, opportunities, and administrative support). When analyzing the challenges EMS described, we also looked for ones that did not fall within the previous categories as well as nuance that was specific to the EMS’ context as a classroom teacher. After coding the data for each teacher, we conducted cross-case synthesis (Yin, 2014) to look for patterns and variations across each of the participants’ experiences. For example, one pattern we noticed across multiple cases were instances where teachers

<sup>1</sup> Standardized testing scores indicate the percent of students who scored either proficient or advanced on the state’s end of year test at the teacher’s grade in the year prior to the interviews.

downplayed the informal conversations they had with colleagues as examples of leadership. We also noticed variation in the types of leadership opportunities afforded to each teacher; for example, some teachers had extensive opportunities to provide leadership in mathematics, including multiple direct invitations from administrators, while in other cases it was unclear whether administrators were aware of the teacher's completion of the EMS program.

## Results

Table 2 shows the leadership opportunities EMS case study teachers engaged in within their primary role as classroom teachers. As shown in the table, there was a significant overlap between formal versus informal and support versus developmental leadership tasks. Specifically, the majority of EMS' formal leadership tasks were supportive in nature, while nearly all of the informal leadership tasks were developmental. This finding highlights the potential value of informal activities in supporting teachers' knowledge for teaching mathematics and the need for more formal leadership activities that are developmental. Note that the classification of leadership tasks as being developmental or support reflect the specific contexts of the case study teachers and are not intended to imply that similar leadership tasks in other contexts would have the same function.

### Formal Leadership

EMS served in a variety of formal leadership roles that involved both support and developmental leadership tasks. Three EMS (Amy, Denise, and Keri) did not engage in any formal leadership activities. Others, like Leah, had several formal leadership responsibilities, including serving on multiple committees and being selected specifically by administrators to assist with math-specific supports. Some formal assignments were long-term, such as serving on a multi-grade level math committee (Taylor) or facilitating a grade level professional learning team (Joni), while others were short term, such as designing and delivering a professional development session for other teachers (Mary).

A majority of the formal tasks EMS performed were supportive in nature, rather than developmental. For example, Emma described serving on a "vertical planning/PD" committee at the school level. The committee met weekly and discussed issues of content coverage ("this is the three

things we have to teach, and then we'll go and day by day... you know, this is fourteen days, how is this going to look") and the use of materials ("combine and share resources"). These discussions did not appear to support teachers to learn how lessons would be enacted, how students might respond, what misconceptions would surface, etc. Leah also described helping her principal analyze data from the multiple standardized tests and end-of-chapter tests that students took throughout the year in order to develop "a data wall that will allow us to look at any kiddo in the school and see, you know, where they are." Similar to Emma's work on the planning committee, this leadership task was supportive in nature because its use was limited to information purposes and was not used to influence instruction or deepen teachers' understanding of students' knowledge of specific mathematics content.

Joni engaged in formal leadership by serving on a team to develop processes for Professional Learning Communities (PLCs) in her school. When describing the tasks of the team, she talked about defining "essential standards" that would provide guidance for teachers about what content they should prioritize in each grade (a support task). But she also seemed to recognize that this fell short of the developmental guidance she felt was needed, making statements like, "we're starting to prioritize our standards with the PLC process...but as far as taking [leadership] further, I haven't," and "we unfortunately start and then haven't always followed through with everything." She lamented that the current approach focused on identifying priority learning standards, saying "there's just so much that I feel we're missing out on." We interpreted these comments as Joni's recognition of the unrealized potential of the PLC work. She saw the identification of essential standards as helping teachers know what content to prioritize in their classroom, but failing to ultimately improve their understanding of the mathematics in the standards or how it could be effectively taught.

Some of the EMS did engage in formal leadership that involved developmental tasks. For example, Mary talked about facilitating a "math lab," a structure established by administrators, in which "teachers who feel comfortable in certain areas can host other teachers within the district" to observe and debrief a lesson highlighting a particular practice<sup>1</sup>. Her math lab addressed mathematical problem

<sup>1</sup> Unlike in math labs reported in literature (e.g., Gibbons et al., 2017), the ones in Mary's district were led by volunteer classroom teachers rather than math coaches or university faculty. Participants in the math lab observed and reflected on the lesson, but were not involved in the lesson planning process.

Table 2: EMS Participants' Leadership Opportunities

	Formal	Informal
Amy		<ul style="list-style-type: none"> <li>• <b>Engaged in conversations with colleagues about implementing a math routine in class</b></li> <li>• Advocated for team-approach to grade level subjects</li> </ul>
Denise		
Emma	<ul style="list-style-type: none"> <li>• Mentored student teacher</li> <li>• Served on vertical Planning/PD committee</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Engaged in informal math conversations with colleagues</b></li> <li>• Mapped out units with other grade level teachers</li> </ul>
Joni	<ul style="list-style-type: none"> <li>• Served on curriculum committee</li> <li>• Led formation of PLCs focused on math</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Co-planned with another teacher</b></li> <li>• Led math night for parents</li> </ul>
Keri		<ul style="list-style-type: none"> <li>• <b>Collaborated with spxsocial ed co-teacher</b></li> <li>• <b>Engaged in informal math conversations with colleagues</b></li> </ul>
Leah	<ul style="list-style-type: none"> <li>• Served as grade level chair</li> <li>• Served on building leadership team</li> <li>• Served on scheduling committee</li> <li>• Mentored new teachers</li> <li>• Assisted principal in analyzing standardized testing data</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Engaged in informal math conversations with colleagues</b></li> <li>• <b>Provided feedback on curriculum enactment in a colleague's classroom</b></li> </ul>
Mary	<ul style="list-style-type: none"> <li>• <b>Facilitated course for EMS</b></li> <li>• <b>Led embedded PD within district on a math practice (with peer observations)</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Engaged in informal mentoring of colleagues</b></li> <li>• <b>Planned and led discussions around math lessons for 4th grade team</b></li> </ul>
Taylor	<ul style="list-style-type: none"> <li>• Served on 3rd – 5th grade math leadership team at school</li> <li>• <b>Served on math committee in district</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Co-planned with another teacher</b></li> </ul>

Note: Bolded leadership activities were developmental tasks, while the remaining activities were support tasks.

solving; she used the opportunity to challenge the idea that problem solving was synonymous with “doing word problems.” She discussed the need to “shift our paradigm here a little bit from what we in the past have thought of problem solving,” and described follow up conversations with teachers about specific teaching challenges. In contrast to EMS who described formal leadership opportunities as primarily focused on the scope and sequence of lessons, Mary was able to use her session to promote teacher learning about a specific mathematical practice. Similarly, Taylor had a formal leadership role as a member of a district mathematics curriculum committee. The task force “spent some time looking at how different strategies that students use to add, subtract, multiply and divide across the grade levels” and described “building a

foundation for repeated addition or multiplication.” This type of document had the potential to help her colleagues anticipate possible strategies that students might use and how they might connect these strategies to support students in building on their prior knowledge. While multiple EMS were able to engage in leadership tasks focused on mathematics, only the tasks completed by Mary and Taylor appeared to contribute to improving their colleagues’ knowledge of teaching mathematics.

### Informal Leadership

In contrast to the formal leadership tasks that were primarily focused on support, nearly all of the teachers’ reported opportunities for informal leadership were developmental in nature. These opportunities included engaging



in hallway conversations about teaching particular mathematics topics and working with teachers after school to expand the strategies students used during instruction. For example, Amy talked about helping other second-grade teachers strengthen their classroom discussion during the *Rocket Math* (a math fluency program) portion of the lesson.

I get the problems I'm gonna use from the top of my *Rocket Math* sheets, but I get my strategies from the Van de Walle book....The 2nd grade team, they all came up one day after school. We spent like an hour and a half in my room, going through what we do in *Rocket Math*, and they've started doing it, and they're like 'it's amazing, you should see what they're doing.'<sup>2</sup>

This informal opportunity to support colleagues in improving their mathematics instruction emerged from other teachers recognizing and seeking out Amy for her mathematical expertise. Instead of focusing on procedures and skills as intended by the *Rocket Math* program, Amy supported other teachers to develop students' flexibility with different computational strategies.

Another form of informal leadership common among the EMS teachers was sharing resources and co-planning with others. Keri shared that, like Amy, others had sought her out for information about teaching particular content.

There is a fourth-grade teacher, she went to the Guided Math [professional development program] with me, and she went back and she is like "I am trying to teach angles and I can't find, they are not getting it, do you have any suggestions for lessons?" So I gave her some stuff that I had found or that I thought would be good for them to understand it.

Through this informal leadership, Keri used her mathematics expertise to offer another teacher access to information and advice about mathematics teaching. Similarly, Leah described teachers stopping her in the hallway to ask for advice about how to teach specific content. "Another teacher asked me, I'm struggling with getting my kids to learn long division, like can you offer me some suggestions? So a lot of things [informal leadership] like that have been, oh we know you're the math person so...." Leah referenced the fact that both her administration and

colleagues saw her as "the math person in the building" due to her expertise as an EMS multiple times when describing the varied leadership tasks she completed throughout the school year.

Looking across the case study participants, we found that the formal leadership opportunities EMS engaged in tended to be support tasks while nearly all of the informal leadership opportunities were developmental in nature. This pattern highlights a strong willingness among EMS to utilize their expertise to engage in developmental tasks, or as Helterbran (2010) put it, to take ownership of instructional problems and to engage collaboratively with colleagues to lead innovative efforts to improve instruction. It also affirms teachers with content and pedagogical expertise as effective interpreters of the instructional functions of teacher leadership tasks (Spillane 2000).

### *Challenges EMS Faced in Engaging in Leadership*

Although nearly all of our case study teachers performed some leadership tasks, many EMS also described challenges they faced in engaging in leadership while maintaining their primary role as a classroom teacher. In this next section, we describe four categories of challenges faced by some of the teachers: a lack of opportunities to engage in leadership; a mismatch between the EMS and administration or other teachers' expectations for the leadership tasks; a lack of clarity regarding formal and informal leadership roles; and, in the case of Denise, the administration not recognizing her mathematics expertise.

#### **A Lack of Time and Opportunities to Engage in Leadership**

Multiple EMS referenced not being able to take on more leadership tasks due to time constraints or being the only math teacher at their grade. For example, Joni described not being able to exercise leadership "as much as I would like to" because of time limitations. "Honestly it comes back to time and I feel like as a school, we're just spread thin as far like what we're trying to do with our time and energy and things like that." Joni's expression of feeling stretched thin was common among the teachers. Leah, our case study teacher who engaged in the most leadership tasks, also expressed being overwhelmed by the amount

<sup>2</sup> This is a reference to *Elementary and Middle School Mathematics* by Van de Walle, Karp, & Bay-Williams (2013), a book used in several of the courses in the EMS program.

of time she spent on multiple support and developmental leadership tasks on top of her regular duties as a classroom teacher.

It ended up being kind of frustrating because I was giving up so much of my time to [leadership tasks], and I didn't mind doing that because I knew it was benefitting other teachers, it was benefitting those kids, but then still having my same workload as everybody else and having you know almost no plan time got to be very frustrating by the end of the year.

While Leah was interested and willing to engage in a variety of leadership tasks to help support her colleagues and school, the workload quickly became unsustainable due to the leadership tasks being unpaid labor that had to be either squeezed into her regular teaching day or performed outside of traditional school hours.

Another issue that surfaced for Denise and Joni was a lack of opportunities to engage in leadership due to being the only math teacher at their grade level. In Denise's case, her school had a "departmentalized" structure where she taught math to the entire fourth grade in three separate sections while the other 4th grade teachers taught the remaining subjects. As a result, she described having limited opportunities for collaboration across content areas: "we've done unit stuff, like, 'what can we do that relates?' But not collaborative." Elsewhere she commented, "We're all departmentalized so [we are] not sitting and lesson planning together." Without such opportunities, Denise struggled to position herself as an expert to whom colleagues could turn for advice.

Like Denise, Joni did not have any opportunities to collaborate with colleagues due to being the only 5th grade mathematics teacher at her school. Despite this, Joni found ways to collaborate electronically with a 5th grade teacher at a different school in her district who sought her expertise. While she found this collaboration to be beneficial, she reflected that "it's not as collaborative as if we were teaching in the same building or even if, I mean, it's just not the same. It can't be, it isn't, and the dynamics of the school system and whatnot." These challenges described by Leah, Denise, and Joni seem to be immediately related to their role as EMS classroom teachers. That is, as continuing classroom teachers, EMS' leadership practice must necessarily fit within the constraints of full-time teaching responsibilities including sometimes being the

sole grade-level mathematics teacher without colleagues to collaborate with.

### **Mismatched Expectations for Leadership Tasks**

Some EMS also expressed challenges that highlighted a mismatch between their goal for leadership tasks to be developmental with others' goals for it to stay at the support level. For example, Leah described having "mixed feelings" about her work with the principal in analyzing standardized testing data, specifically around the lack of plans for how to use the analysis to inform instruction.

It's okay to look at data, but then I think we need to be doing something with that data and that data needs to be driving something and it's really not at this point.... I don't see us like—okay so our kids are low in math, we're seeing a trend, so what are we doing to change that? Nothing.... It's like you know we're assessing our kids to death, just for data points for what? I don't even know. Um, just to prove that I guess we're in here teaching.

Although Leah had the knowledge and skills needed to interpret the standardized data and identify ways it could be used to inform instruction, she was not able to enact this vision because it conflicted with what she understood to be her principal's goal of using the data for tracking purposes.

Similarly, Taylor experienced conflicts between her vision for supporting mathematics instruction and the expectations of colleagues. Within her role as a member of the district's math curriculum committee, Taylor worked with colleagues to create a document describing student strategies for whole number operations across the grade bands. She recognized the potential for this document to help other teachers make informed decisions in their classes, but found that her fellow committee members seemed disinterested in extending their work beyond the committee meetings.

It's difficult, it's, in the sense of, people are happy to be on the committee and to talk about math, but only so much is going to be solved when you meet for 20 minutes once a month. [...] The struggle has been now that we have this information of different strategies that students use, what are we going to do with it, and that's where I see people saying, we have the document, we're happy with that versus what are we going to do

with it. So that's been the struggle of bridging it from now we have this information, how can we make sense of it and use it to benefit our teaching and our instruction and our students' learning.

Taylor's expertise enabled her to recognize the value in the committee's work and see the potential for it to support teachers' learning of student strategies for whole number operations; however, she desired for their work to more directly connect to teachers' practice. At the time of our interview, Taylor was still trying to navigate her role on the committee and find opportunities to extend the work they did to support the instruction of other classroom teachers.

### **Lack of Clarity Regarding Formal and Informal Leadership Roles**

One of our case study teachers, Amy, was in the unique position of having spent ten years as a math and literacy coach before returning to be a full-time classroom teacher. She taught in a school district that had a formal math coach; this math coach had completed the EMS program alongside Amy and Denise. Given her prior experiences, Amy expressed being initially cautious when trying to engage in leadership tasks within her role as classroom teacher. "I had to kinda feel things out and find where I fit, a little bit, before people ever started asking me about math." By the end of the school year, Amy reported that she had begun to informally "coach afar" when colleagues asked her questions; however, she still seemed to be figuring out how to engage in leadership tasks in a way that did not clash with the work being done by the math coach. "I'm slowly getting out into the school, but...I also don't want to overstep my bounds. Because I was a coach, and I don't want my coach in my building thinking that I'm trying to overstep her, you know." Amy's reflections highlight a tension that can arise between those who hold formal leadership positions and those who seek to engage in leadership tasks in a more informal capacity from the classroom. While it is certainly natural to look to those in formal leadership positions for guidance, the presence of a math coach or specialist should not preclude others from also engaging in leadership tasks. Based on our observations and interviews with the classroom teachers, we believe that Amy and Denise would have benefitted from additional clarity around the formal and informal leadership roles and a broader discussion around ways they could support the math coach in engaging in mathematics leadership at their school. As evident from other cases in this study, full

time classroom teachers can engage in meaningful leadership tasks despite not having a formal leadership position.

### **Administration Not Recognizing the EMS' Mathematics Expertise**

Unlike the other EMS, Denise struggled to engage in any leadership task, formal or informal, at her school. Her difficulties in engaging in leadership appeared to be due to two main factors: first, the way that fourth graders were divided into classes at her school limited her opportunities for collaboration; second, her administration and colleagues did not recognize her mathematics expertise. Instead of automatically assigning all students to multiple fourth grade classrooms, Denise's school also had a mixed-age class (2nd-4th graders) that selected a small group of students to attend based on their application. Even though Denise taught nearly all of the fourth graders, including special education students and English Language learners, her principal would compare her scores with those of the students who were in the mixed-age class.

Being honest, I feel I'm in the underdog position, 'cause I'm always compared. I have the majority of the fourth grade compared to our mixed age class. And they only have like five percent...And so, they always compare those scores to my scores. And they're always wanting me to ask her what is she doing differently.

Although Denise had developed specialized content knowledge and leadership capacity through the EMS program, she was positioned by administration as a teacher needing additional support because her students had lower test scores than those fourth graders in the mixed-age class. Denise characterized her principal's view of expertise and legitimacy as coursing primarily through the lens of standardized test scores. Given the inappropriate comparison across two demographically different groups of students, she felt her expertise went largely unacknowledged. That administration did not recognize Denise's expertise played a significant role in her leadership opportunities given her role as an EMS classroom teacher who did not have authority and legitimacy afforded to her through a formal leadership position.

### *Discussion*

Through completing EMS programs, teachers deepen their knowledge of elementary content and reinforce principles of high quality mathematics instruction across the elementary

curriculum (Campbell & Malkus, 2014; Swars et al., 2018). While developing their content knowledge for teaching is a large component of EMS programs, graduates also gain leadership skills that allow them to engage in tasks not typically assigned to classroom teachers (e.g., analyzing standardized testing data, leading professional development, and coaching or mentoring other teachers) (McGatha & Rigelman, 2017). To date, the majority of the EMS research focuses on formal leaders, like mathematics coaches (de Araujo, 2015). The experiences of our case study teachers (Table 2) contribute to this literature by highlighting some of the varied ways that EMS can engage in leadership while remaining in their primary role as classroom teachers. Although both support and developmental leadership tasks can assist teachers in fulfilling their teaching responsibilities, only developmental tasks increase human capital and can lead to long-term gain in teachers' knowledge (Gigante & Firestone, 2008). We extend this literature by showing that the informal leadership tasks our case study participants engaged in provided them with more opportunities to increase their colleagues' knowledge of teaching mathematics (developmental) than the formal leadership tasks. These findings also provide additional support to findings that coaches with formal leadership positions often spend large portions of their time on logistical and administrative activities (i.e., support tasks; Knight, 2012; Kane & Rosenquist, 2019) rather than developmental tasks.

Collectively, our case study teachers had the expertise and willingness to engage in leadership tasks but had varied opportunities to do so within their primary role as a classroom teacher. We identified four types of challenges some of them faced as they navigated their role as a teacher leader: a lack of opportunities to engage in leadership due to limited time or few colleagues who taught mathematics; a mismatch between the EMS and administration or other teachers' expectations for the leadership tasks; a lack of clarity regarding formal and informal leadership roles; and the administration not recognizing the EMS' expertise. Our findings support earlier research on the various challenges teacher leaders—those with and without formal positions—face (Wenner & Campbell, 2017; York-Barr & Duke, 2004) and extends it by describing how such challenges might be particularly salient for those that continue as classroom teachers (Smith et al., 2017). For example, some EMS teachers (Denise and Amy) struggled to establish legitimacy or clarity around their leadership without a formal position, while others (like Joni) were constrained

by a lack of time stemming from their full time classroom responsibilities.

Given the importance of developmental tasks (Gigante & Firestone, 2008), and the legitimacy that comes with formal roles (Berg & Zoellick, 2019), we believe there is a need for more structures in place within schools and districts that supports teacher leaders to engage in formal leadership tasks that are developmental in focus. As EMS take on such leadership tasks, however, it is important that administrators and other stakeholders understand and recognize the challenges they may face and seek ways to empower and support these instructional experts in their improvement efforts. In the following sections, we draw on the experiences of the case study participants to provide recommendations for ways that different stakeholders can support EMS in engaging in leadership while maintaining their role as a classroom teacher.

## *Implications for Practice*

### **District and School Administrators**

A common theme across the experiences of our case study participants was the important role that their principals played (or did not play) in helping them share their expertise and engage in leadership. In particular, the cases of Leah and Denise demonstrate the importance of administration recognizing the mathematics expertise teachers gain through EMS programs and publicly legitimizing them as a leader and resource for other teachers. Alongside publicly acknowledging the EMS' expertise, principals can also support the teachers in expanding their view of what counts as being a teacher leader to encompass both formal and informal leadership tasks and giving them more space to shape the nature of their tasks, including freedom to make them more focused on teacher learning (developmental). Like most of the teachers in our study, EMS may already have colleagues who hold them in regard as leaders because of their expertise and interactive styles. However, this study corroborates conclusions from Spillane & colleagues over multiple studies (Burch & Spillane, 2003; Diamond & Spillane, 2016; Spillane et al., 2003) that teacher leaders still depend upon administrators to legitimize their leadership, to develop a shared instructional vision, and to provide supportive structural and organizational arrangements, such as schedules that support collaboration and the creation of subject-specific formal leadership positions. Administrators can also provide more space for specialists to shape the nature of

their formal tasks, including freedom to make them more focused on teacher learning (i.e., developmental) and less on logistics or program support. Finally, administrators can help to minimize hesitancy some EMS might experience through engaging in regular conversations with them around the types of leadership opportunities they are interested in pursuing and supporting them as they navigate those spaces.

Smaller districts in particular can utilize the expertise of EMS through providing and supporting them to engage in varied leadership at their school while still retaining their primary responsibility as a classroom teacher. The example from Mary of having colleagues observe her teaching and then participate in discussions before and after the lesson is one way that EMS can share their expertise with colleagues without a significant time commitment. For leadership tasks that require a significant time commitment, schools should consider ways to support the EMS by giving them additional time in the school day for leadership tasks (e.g., through not having to teach a particular subject or receiving a release from non-academic supervision duties) and/or providing additional pay for the increased duties. While achieving this would likely require creativity on the part of the administration, it would provide increased opportunities for support and professional development for other teachers without having to fund a full-time mathematics coach or specialist.

### Mathematics Coaches

Educators who are employed formally as mathematics instructional coaches have the opportunity to leverage the expertise of EMS in their district to form a network of mathematics instructional leadership. Mathematics coaches can serve as advocates for teacher leadership as they highlight pockets of expertise among the teachers with whom they work, spurring elementary administrators to view *inside* expertise as the most important factor for shifting mathematics instruction and achievement in their building. Mathematics coaches should push to engage a high percentage of developmental work (e.g. collaborative task/lesson design, modeling or team teaching, facilitating professional development with teachers) for two reasons – these have been shown to have greater impact on increasing teacher skill and knowledge and these kinds of tasks put coaches in-the-know about which teachers have developed or are developing the expertise to lead innovative mathematics instruction in their building. Mathematics coaches can also put promising teachers in touch with

resources for developing further expertise, such as EMS training and certification programs.

### Teacher Leaders

We also encourage teacher leaders, including EMS, to expand their views of leadership beyond formal opportunities such as facilitating professional development and serving on committees. Sharing their knowledge and expertise about mathematics teaching in informal settings, like hallway conversations, are important forms of leadership as these were often developmental in nature and contributed to the learning and practice of colleagues. These forms of leadership may be particularly effective by EMS that continue as classroom teachers since others may view them as more credible sources than formal leaders who are no longer teachers (Spillane & Kim, 2012). And, because teacher leadership is rooted in how others perceive expertise and legitimacy (Berg & Zoellick, 2019), we also encourage teacher leaders to publicly share with colleagues and administrators their emerging knowledge and forms of expertise and how these may support the school community.

When seeking out leadership opportunities, we encourage EMS to be selective when taking on leadership roles and to specifically look for tasks that allow opportunities for sharing and developing content knowledge expertise. This will maximize the limited time they have for leadership activities and minimize burnout. For example, Leah's desire to be a teacher leader at her school resulted in her taking on multiple roles, including ones that were not specific to mathematics. By the end of the school year, she expressed frustration with the amount of unpaid leadership tasks she was completing each week and was left feeling like they were negatively impacting both her professional and personal life. We argue that spending time working closely with colleagues to advance their knowledge of teaching will result in greater change in the long run than serving in formal leadership roles that are focused primarily on logistics or programmatic concerns.

In addition, our results suggest that teacher leaders might advocate for more say regarding the nature of their formal tasks. For example, Joni expressed disappointment about the task of assigning priority standards for each grade level, seeming to recognize the limitations of the task in influence teacher knowledge or practice. She had ideas for more productive activities for Professional Learning Communities, but apparently was not able to advocate for these ideas. We hope that this article provides some support

for teacher leaders to use in negotiations with administrators as they lobby for more attention to developmental work, and for more power in deciding the kinds of activities that they are charged with carrying out.

### **Elementary Mathematics Specialists Programs**

In addition to providing opportunities for teachers to develop leadership skills in formal roles, our findings suggest that they should also specifically prepare graduates to 1) advocate for increased attention to development tasks within those roles, as noted in the previous point, and 2) engage in developmental activity through informal means (e.g., hallway conversations with colleagues, team planning meetings). Joni and Taylor in particular articulated frustrations with the progress being made in their schools, lamenting that there was not more attention to issues of teaching and learning within the formal structures for support for mathematics teaching. These issues could be the focus of conversations and problem solving within EMS programs. In addition, EMS programs could engage in advocacy for their graduates by communicating with school administrators and providing suggestions for leadership tasks and roles that might empower EMS in order to support teacher learning.

### *Areas for Future Research*

One of the key findings from this study was the tendency for informal leadership tasks to be developmental and formal leadership tasks to be supportive in nature. Future research could further explore this potential relationship in order to better understand the contextual features that resulted in only some of the leadership tasks lending itself to increasing colleagues' knowledge for teaching mathematics as well as explore whether the pattern of both developmental and support tasks occur in other contexts. For example, to what extent can the presence of developmental leadership tasks be attributed to the specialized content knowledge teacher leaders gained through the EMS program?

While this study focused on the teachers' perspective, future research could provide a more nuanced understanding of the impact EMS have on the knowledge of their

colleagues through incorporating the voices of those who interacted with them while they were engaging in leadership acts. For example, to what extent do colleagues report an increase in their knowledge of teaching mathematics as a result of the EMS' formal or informal leadership acts? In what ways, if at all, do these leadership acts result in increased collaboration among teachers? Administrators also played an important role in terms of expanding (in the case of Leah) or constraining (in the case of Denise) the EMS' opportunities for leadership. Future research could incorporate administrator's voices to better understand the extent to which they were aware of the EMS' interest in engaging in leadership and their perspectives in how to address the challenges EMS faced in their leadership endeavors.

### *Final Remarks*

EMS programs were developed with the goal of improving elementary mathematics instruction by equipping teachers with specialized content knowledge, teaching practices, and leadership skills (AMTE, 2013). While some graduates of EMS programs go on to formal leadership roles (e.g., as a mathematics coach or instructional specialist), others choose to stay in their positions as full time classroom teachers. EMS-certified classroom teachers are well-positioned to support sustained reform in mathematics instruction because of their regular, informal interactions with colleagues and their ability to maintain status as a peer and collaborator (Spillane & Kim, 2012). As illustrated by our case study participants, EMS can share their expertise with colleagues through engaging in both formal and informal leadership tasks such as participating in math-related committees, leading professional development, and informally sharing resources and teaching strategies. Navigating the role of teacher leader is not without its challenges. Various stakeholders can support EMS in overcoming these challenges by publicly recognizing their expertise and positioning them as a leader, providing time within the regular school day to engage in leadership tasks, seeking out ways for EMS to engage in developmental rather than support leadership tasks, and providing clarity in leadership expectations in situations where there is someone in a formal leadership position. ✪

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