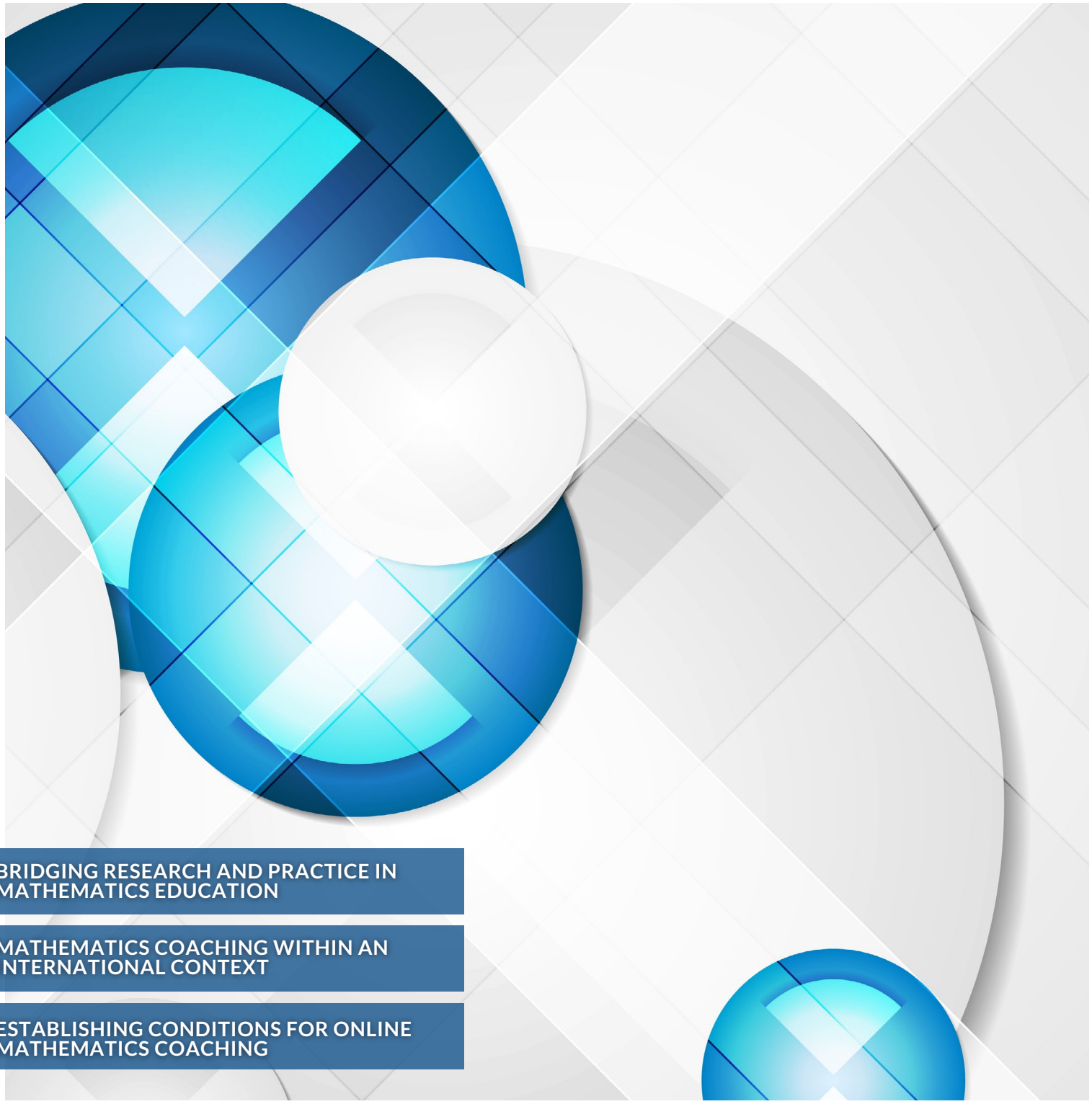
VOLUME 33 | ISSUE 1 | SPRING 2026

NCSM JOURNAL

OF MATHEMATICS EDUCATION LEADERSHIP



BRIDGING RESEARCH AND PRACTICE IN MATHEMATICS EDUCATION

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BRIDGING RESEARCH AND PRACTICE IN MATHEMATICS EDUCATION: EXPLORING DISTRICT-LEVEL MATHEMATICS SPECIALISTS' RESPONSIBILITIES AND PROFESSIONAL LEARNING NEEDS

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ABSTRACT

This exploratory study and related analysis investigated the roles, responsibilities, and professional learning needs of school district-based mathematics specialists (DMSs), who play a crucial role in shaping mathematics education. Despite the potential significance of their influence, limited research exists on what DMSs need to know to influence, support, and lead coherent instructional systems. To address this concern, our research team developed a survey to gather data on DMSs' roles and responsibilities related to professional development and curricular implementation. Findings revealed variability in DMSs' roles, involvement in professional development, influences on goal setting, and professional learning needs. Based on these findings, we offered recommendations for DMSs' implementation of district- and state-wide curriculum initiatives. These state-level insights are generalizable to other areas of the United States and highlight the vital role of DMSs in supporting and enhancing mathematics teaching and learning across school districts nationally.

Over the past 40 years, scholarship on mathematics leadership has expanded considerably (Baker et al., 2021; Herbst et al., 2021), though researchers have predominantly emphasized school-based mathematics specialists (Baker et al., 2021). Prior studies have documented how school-based mathematics specialists enact a variety of responsibilities (Mudzimiri et al., 2014), cultivate leadership identities (Chval et al., 2010), and influence classroom instruction and professional learning (Campbell et al., 2017). More recently, researchers have begun to expand this line of inquiry to the district level, examining the work of district-based mathematics specialists (DMSs; Baker et al., 2023; Herbst et al., 2021), yet the field lacks a robust understanding of how DMSs develop and apply the knowledge and practices needed to guide systemwide instructional improvement (Jackson et al., 2018).

As a primary professional organization for DMSs, the National Council of Supervisors of Mathematics (NCSM) has long recognized their critical role in shaping mathematics education. Since its founding in 1968, NCSM has provided a platform for DMSs to share ideas, address emerging challenges, and engage in ongoing study of specialized issues in the field. According to NCSM's first president, Louis Scholl (1970), one of the main aims of the National Council of Supervisors of Mathematics is to maintain an ongoing focus on examining specialized issues within mathematics education. NCSM has contributed to the development of more coherent and effective mathematics instructional systems by fostering collaboration and professional learning among district leaders. However, despite this longstanding professional recognition, empirical research on DMSs' roles, responsibilities, and professional development (PD) needs has remained limited (Bolyard & Baker, 2025).

DMSs hold pivotal positions in shaping the direction and quality of mathematics education across school systems (Burch & Spillane, 2003). Serving as critical intermediaries between a school district's administration and classroom practices (Jarry-Shore et al., 2023), DMSs lead efforts to enhance teachers' instructional practices (Hopkins et al., 2017), guide mathematics curriculum development (Munter et al., 2023; Rigby et al., 2018), and ensure alignment with state and national standards (Whitworth et al., 2017). Through this work, DMSs ensure the establishment of a "coherent instructional system at the school level" (Jackson et al., 2018, p. 193).

Building on the emerging field of DMS research (Munter et al., 2023), this paper presented an exploratory investigation into the responsibilities and needs of DMSs. The study also considered how DMSs address these responsibilities themselves. The inquiry was guided by a series of wonderings designed to assess both current practices and PD needs of district mathematics leaders in the state of Virginia: (a) What are the roles and responsibilities of DMSs in Virginia? (b) How are these related to goals and instructional needs of school districts and schools? (c) How are DMSs engaged in state-, district-, and school-level change? and (d) What are the professional learning needs of DMSs? In the following sections, we provide background literature on DMSs, detail our exploratory research approach, and explain the intent behind our survey instrument, shedding light on key factors shaping the work of these critical education leaders.

CONCEPTUAL FRAMING: THE NEED FOR GREATER CLARITY ON DMS

Despite broad recognition of the impact district-based mathematics leaders have on improving mathematics teaching and learning, DMSs have received limited attention in literature (Baker et al., 2023; Lochmiller, 2015). Existing work on district leadership conceptualized it "as a generic enterprise" (Stein & D'Amico, 2000, p. 1) despite the recognition that content specificity matters in instructional improvement efforts. Further, researchers have generally overlooked the specialized role of DMSs (Baker et al., 2021), focusing instead on other educational leadership positions (e.g., superintendents, principals; Herbst et al., 2021). In fact, Jackson et al. (2018) emphasized, "The existing research was thin with regard to what central office leaders need to know and do in order to support the development of coherent instructional systems" (p. 194). Such a gap underscores the need to explore how DMSs can be supported and how their leadership advances ambitious, equitable mathematics instruction (Lampert et al., 2011). Understanding DMSs' contexts, roles, and responsibilities—and how they facilitate instructional improvement across districts—is critical for informing research, policy, and practice.

The following sections situate DMSs in the existing literature, highlighting what is known about their roles, responsibilities, and challenges while identifying key gaps warranting further study. To guide readers, we organized the conceptual framing into three interrelated areas: (a) knowledge limitations in DMS research, (b) variability in DMS contexts, and (c) core DMS roles and responsibilities. Together, these three areas provide a comprehensive lens for understanding DMS work; variability and knowledge limitations frame the challenges and constraints DMSs face, and core roles and responsibilities illustrate how they act in those contexts. Examining these areas in tandem allowed for a more nuanced understanding of the complexities of DMS leadership and identified where future research and practice can better support the work of the DMS in advancing equitable, high-quality mathematics instruction.

Knowledge Limitations in DMS Research

For close to 4 decades, a great deal of research has focused on ways superintendents (Liang et al., 2020; Murphy & Hallinger, 1986); principals (Lee & Lee, 2020; Manasse, 1985); and, to a lesser extent, school district offices (Mac Iver et al., 2019) lead instructional improvement efforts. Research on superintendents has examined a wide variety of dynamics, including the impact of reform and accountability agendas on their work (Bredeson & Kose, 2007) and how they set instructional goals (Nino et al., 2018) and self-identify professional learning needs (Spanneut et al., 2011). Educator preparation scholars have engaged in a similarly wide variety of research surrounding the work of principals, such as their PD needs (Foley, 2001), development of instructional goals (Lee & Lee, 2020), and preparedness to implement culturally responsive school leadership (Holmes & Hope, 2023). Despite this extensive research on other district- and school-level leaders, DMSs have remained largely overlooked. Although DMSs are influential to the success and sustainability of mathematics reform initiatives, rarely have researchers captured their insights or perspectives as part of systemic change efforts or content specialists in district leadership (Hjalmarson & Baker, 2020). Of 130 articles identified in a recent research synthesis on mathematics specialists broadly (Baker et al., 2021), only eight articles (5%) published between 1981 and 2021 mentioned DMSs. This number only captured the quantity of articles that mentioned DMSs; it did not speak to the DMSs' responsibilities and impact described in the articles. Such paltry representation of DMSs in research is paralleled in existing standards for their preparation.

National organizations have published standards for the preparation of PreK–12 teachers (Association of Mathematics Teacher Educators [AMTE], 2017) and school-level mathematics specialists (AMTE, 2024). We also identified a recently revised joint position statement that advocated for K–6 mathematics specialists (AMTE, Association of State Supervisors of Mathematics, NCSM, & National Council of Teachers of Mathematics [NCTM], 2022) to ensure equitable and effective mathematics learning opportunities in the classroom. However, no such preparation standards or position statements exist that have addressed and supported the preparation, importance, and impact of DMSs. This oversight has resulted in a limited knowledge base of what DMSs need to know and do to lead and support the development of coherent instructional systems focused on mathematics (Jackson et al., 2018).

Variability in DMS Contexts

If the field of mathematics education is to consider how to bring ambitious mathematics teaching (Lampert et al., 2011) and learning to scale (Cobb et al., 2018), it is essential to study the work of DMSs because these individuals have significant influence over the teaching and learning of mathematics (Baker et al., 2022; Jackson et al., 2018). DMSs work to make instructional changes within school systems that are subject to the influence of political, fiscal, and social changes; policy changes; long-established school structures; and conflicting ideas about the purpose of schooling and approaches to improving instruction (Jackson et al., 2018; Shields et al., 1999). To support DMSs to both envision and enact mathematics improvement efforts, it is essential to understand how DMSs make sense of, plan for, and enact instructional reform (Burch & Spillane, 2003) to influence PreK–12 mathematics teaching and learning at scale (Jackson et al., 2018).

Despite their critical role in supporting mathematics instruction, the position of DMSs lacks consistent definition, with substantial variation in titles (Greenes, 2013) across districts and states (Baker et al., 2022; Bolyard & Baker, 2025). Titles range from mathematics-specific designations (e.g., mathematics supervisor, mathematics coordinator) to broader labels (e.g., instructional specialist, STEM coordinator). This inconsistency, coupled with ambiguity regarding responsibilities (Munter et al., 2023), obscures understanding of both the scope of role and types of support DMSs need (Bolyard & Baker, 2025). Such variability complicates efforts to define and study the position and can

hinder DMSs' abilities to enact content-specific leadership effectively (Greenes, 2013; Obara & Sloan, 2009). To advance mathematics improvement efforts, it is essential to examine how these inconsistencies influence DMSs' work and the support they need for curriculum development, instructional leadership, and professional learning.

Clarifying the contextual nature of DMS leadership in research is particularly important because these positions shape the design and enactment of ambitious, equitable mathematics instruction directly. As noted previously, given the wide variation in DMS titles (Greenes, 2013) and responsibilities (Munter et al., 2023), research and practice must clearly articulate the contextual differences of the DMS position to better understand and define these distinctions (Baker et al., 2021). Consequently, the field should investigate how DMSs develop the content-specific knowledge, skills, and dispositions required to lead instructional improvement efforts (Jackson et al., 2018) because these aspects remain largely unexplored (Bolyard & Baker, 2025).

Core DMSs Roles and Responsibilities

The role of a DMS is complex and demanding (Bolyard & Baker, 2025) because these leaders play a critical role in advancing PreK–12 mathematics teaching and learning in a school district (National Academies of Sciences, Engineering, and Medicine, 2024; Munter et al., 2023). As school systems strive to improve mathematics outcomes, DMS responsibilities have expanded beyond classroom instruction to broader leadership functions that shape district-wide improvement. Jackson et al. (2018) emphasized that the primary aim of district-level instructional leadership is to "support the development of coherent instructional systems at the school level, thereby building school-level capacity for instructional improvement" (p. 193). Achieving this vision requires DMSs to have expertise in implementing ambitious instruction (Lampert et al., 2011), strengthening teachers' content knowledge through professional learning (Hopkins et al., 2017; Jarry-Shore et al., 2023; Stein & Coburn, 2008), and creating coherent instructional systems (Cobb et al., 2018; Jackson et al., 2018). Although little consensus exists regarding the ways DMSs accomplish these goals, they typically foster the integration of research-informed teaching practices (NCTM, 2024), design and facilitate teacher (Jackson et al., 2018) and school-based mathematics specialist professional learning (Kochmanski et al., 2025), and ensure alignment between district and state policies and priorities (Cobb et al., 2018; Jackson et al., 2018).

Another core responsibility of DMSs is to develop cohesive instructional systems that enhance instructional capacity and improve student engagement and achievement in mathematics (Conference Board of the Mathematical Sciences, 2012; Jackson et al., 2018). How DMSs approach this work is shaped largely by contextual features like DMSs' orientation to improving instruction (Jackson et al., 2018), the strategic vision and priorities of the district (Baker & Knapp, 2023), the size of the district and number of schools they serve (Munter et al., 2023), and the PreK–12 stakeholders with whom they work. DMSs set short- and long-term mathematics goals; collaborate with mathematics coaches, specialists, and principals on school-based initiatives; and work with administrative teams to define their district's vision for mathematics teaching and learning (Fennell, 2018; National Academies of Sciences, Engineering, and Medicine, 2024). Effective DMSs craft a vision for high-quality mathematics instruction, establish clear goals for realizing that vision, and implement practices that are responsive to the needs of their districts (Cobb et al., 2018; Jackson et al., 2018). Yet, the limited extant research has provided little guidance on how DMSs can best accomplish these complex goals (Herbst et al., 2021; Lochmiller, 2015).

Closely linked to this leadership role, DMSs develop and align rigorous, research-based mathematics curricula across diverse classrooms, regularly updating pacing guides, materials, and instructional resources to reflect current research, best practices, and changes in district or state standards (Fennell, 2018). Cobb et al. (2018) emphasized that in districts where instructional decision making occurs largely at the school level, DMSs ensure schools have access to expertise for supporting ambitious (Lampert et al., 2011) and equitable instructional practices (NCTM, 2024). In this context, DMSs play a critical role in establishing a coherent mathematics curriculum framework and facilitating curricular integration, creating a unified approach to mathematics instruction across the district (Greenes, 2013).

Supporting teachers to improve student outcomes is central to the DMS role, ensuring the district's mathematics curriculum aligns with both state standards and broader educational goals. Fennell (2018) noted that curriculum writing and review at the PreK–12 level requires ongoing communication in the district regarding mathematics instructional issues. Munter et al. (2023) posited that district leaders often focus on student outcomes, particularly those reflected in state standardized test scores, as the most pressing challenge, with less attention paid to equity or student experiences—a focus that reflects the current accountability climate in U.S. public education. DMSs use data from formal and informal assessments to guide instruction, target interventions, and ensure equitable access to mathematics learning for all students (Greenes, 2013). DMSs also oversee district-wide communications related to mathematics instruction, conduct formal and informal teacher observations and evaluations, contribute to curriculum development and review, and manage the mathematics program budget to ensure effective allocation of resources (Fennell, 2018).

DMSs play a crucial role in cultivating professional and relational networks that extend across districts and communities (Fennell et al., 2013; Hopkins et al., 2017). By partnering with mathematics coaches, school leaders, and families, DMSs help create inclusive learning environments that promote student success in mathematics (Rigby et al., 2018, 2020; Stephan et al., 2025). They also equip families with tools and resources to support student learning outside of school, strengthening the overall support system for students' education. These networks enable DMSs to bridge organizational boundaries, enhancing collaboration and extending resources for schools (Stephan et al., 2025; Trujillo, 2013). In these collaborative efforts, DMSs work closely with

teachers and school leaders to refine instructional practices, share expertise, and build capacity to address diverse student needs (Stein & Coburn, 2008). DMSs are also integral to the development and delivery of PD opportunities, offering coaching, feedback, and personalized learning experiences to help teachers enhance their instructional strategies. These offerings can include leading workshops, organizing collaborative planning sessions, and integrating new pedagogical techniques or technologies into mathematics instruction. Both formal and informal observations of teachers (Fennell, 2018) also contribute to this continuous professional growth. The role of a DMS requires specialized knowledge and skills to support collective efforts that lead to the ongoing improvement of PreK–12 mathematics education (Hjalmarson & Baker, 2020).

METHODS

The purpose of this exploratory study and related analysis was to better understand the roles, responsibilities, and professional learning needs of DMSs, particularly as they related to PD and curricular implementation. Our survey design, distribution, and analyses are described as follows.

Survey Design

Given the importance of this exploratory investigation and recognizing the absence of an existing survey instrument aligned with our research goals, we developed our own survey instrument by drawing from a range of existing surveys to meet our needs. Our survey drew on existing research and included a combination of categorical, Likert-type, and multiple-response items (see Appendix A). The survey began with 10 items focused on gathering background information about respondents (e.g., location, licensure, role) and six open-response questions aimed at exploring the goals, needs, and challenges of DMSs (adapted from Baker et al., 2021). We also included the following items adapted from the Middle-School Mathematics and the Institutional Setting of Teaching (MIST, n.d.) Coach Survey: eight items addressing the extent to which respondents support mathematics teachers (e.g., providing professional learning), two items centered on the expectations of supervisors and principals, six items focused on DMS professional learning needs, and three items exploring the structure of leadership in the school districts' mathematics networks. We selected this survey to adapt because it was designed to capture the kinds of activities in which we were interested (i.e., activities related to documenting the goals and professional experiences of the DMSs). The survey's multifaceted focus allowed us to gather comprehensive data from participants regarding their roles and the broader context of their work while leveraging existing data collection tools. We anticipated our survey would take approximately 15–20 minutes to complete and seven open-ended questions at the end of the survey questions at the end of the survey. The survey was administered December 2023 through January 2024.

Survey Distribution

The Qualtrics online survey (see Appendix A) was distributed electronically through the Virginia Council of Supervisors of Mathematics (XCSM) listserv, which reached a broad network of district-based mathematics leaders across various educational settings in Virginia. Additionally, as a secondary distribution channel, the survey was shared directly in our state network of DMSs, further broadening the reach of potential participants. These recruitment strategies were designed to elicit prompt responses from DMSs while leveraging an organization with direct access to mathematics leadership personnel across districts. Participants were not compensated for their responses.

Participant Eligibility and Role Definitions

To define the DMS participants for this study, we drew on past research (Bolyard & Baker, 2025) in which the term "district-level mathematics specialist" was used to describe "individuals in formal leadership positions at a school district central office tasked with improving K–12 mathematics teaching and learning across [multiple] schools" (p. 2). Drawing on this work, we defined DMS as an educator employed at the district level with responsibilities including curriculum alignment, instructional coaching, PD, and data-informed decision making for mathematics programs. Participants were included if they (a) self-identified as DMSs, (b) occupied a mathematics leadership position at the district level rather than a school-based position, and (c) had a job title indicating district-level mathematics responsibilities (e.g., curriculum specialist for mathematics, mathematics coordinator). Individuals were excluded if their responsibilities were limited to classroom teaching or school-based coaching without district-wide responsibilities.

Fifty-eight survey responses were received, of which 34 were from DMSs. To ensure alignment with this study's goals, responses from non-DMS participants (e.g., school-based mathematics coaches) were excluded from the analysis. Of the 34 DMS responses, four were incomplete and were excluded to ensure only fully completed surveys were analyzed. This approach resulted in a final data set of 30 complete DMS responses. Participant characteristics are reported in the Results section. Although this sample size was relatively small for a survey study, the research was exploratory in nature, and the resulting analysis offered valuable insights that can inform future studies and guide further investigation into district-level mathematics leadership and DMS practice.

Data Analysis

We employed multiple analyses to interpret the responses to survey items connected to DMS responsibilities. Whereas the quantitative analysis of Survey Parts I–IV provided a descriptive understanding of the DMSs' context, responsibilities, and activities, the qualitative analysis of Survey Part V captured DMSs' goals, challenges, and instructional needs. Early exploration of the quantitative data informed the direction of the qualitative analysis. The two analyses were brought together to understand the themes, particularly the emergence of leadership knowledge and skills, that emerged.

Quantitative Analysis

Given the exploratory nature of this study and the small sample size (n = 30), it was not appropriate to conduct

inferential or major statistical analyses. Instead, the analysis focused on descriptive statistics and simple-group comparisons that were exploratory in nature to summarize response patterns. This approach allowed our analysis to focus on describing trends rather than generalizing to a broader population. The quantitative analysis was conducted based on four distinct sections of the survey (Parts I–IV), each corresponding to a set of survey items with different types of response formats.

Part I (i.e., Items 1–10) gathered background information about participants, including professional titles, grade bands supported, regional affiliations, and years of experience. These items were analyzed using categorical data analysis, with frequencies and percentages used to summarize the distribution of responses across these categories. Part II (Items 11–20) explored participants' professional responsibilities in their districts. Because this section included both categorical and Likert-type questions, descriptive statistics were applied with frequencies and percentages used to highlight patterns in how participants understood and enacted their professional roles. Part III (Items 21–26) examined participants' engagement in and perceptions of professional learning related to mathematics instruction and leadership. This section consisted of categorical, Likert-type, and multiple-response categorical questions. Descriptive analysis using frequencies and percentages captured the extent and nature of participants' professional learning experiences, opportunities, and supports. Finally, Part IV (Items 27–29) focused on the implementation of district mathematics initiatives, identifying the leadership roles (e.g., classroom teachers, mathematics lead teachers, coaches, administrators) most involved in supporting these initiatives in elementary schools. These multiple-response categorical questions were analyzed by counting frequencies and calculating percentages for each category, facilitating the identification of the leadership roles most frequently engaged in supporting district initiatives.

Qualitative Analysis

The analysis of open-ended responses began with hard-copy coding by our research team. An in vivo coding approach (Saldaña, 2021) was employed to honor and preserve participants' own language, ensuring codes reflected what respondents deemed important (Strauss, 1987). Initial codes included examples (e.g., supporting teachers, creating curriculum materials, providing PD). Each response was coded line by line, and our team independently reviewed and applied codes to enhance reliability. To establish coding agreement, we compared independent coding results, discussed discrepancies, and resolved differences through consensus. When necessary, we refined or merged codes to ensure conceptual clarity. Codes were subsequently grouped into broader categories and preliminary themes based on conceptual similarity and frequency. For example, codes related to DMS goal setting (e.g., district and state alignment, PD planning), challenges (e.g., shifting expectations, variability in responsibilities), and instructional needs (e.g., active participation in professional learning, research-informed materials) were clustered to form coherent thematic categories. Final themes (e.g., roles, influences on goal setting, professional learning needs) were selected based on the salience of ideas across participants, coherence in categories, and alignment with the study's research questions.

RESULTS

This section presents the key results of our exploratory investigation into the roles and responsibilities of DMSs. Our analysis revealed how these DMS participants engaged with mathematics instruction, PD, and curriculum implementation across districts in Virginia.

We first provide a descriptive overview of DMSs' roles and context. We then examine the responsibilities and challenges of DMSs, highlighting the ways DMSs facilitate PD and support mathematics teaching and learning. Next, we explore the influences on DMS goal setting, including factors guiding their planning and decision making at the time of the survey. Finally, we considered professional learning needs and support for DMSs, focusing on both sources of advice and informal support and their participation in PD. Together, these sections offered a nuanced understanding of the complexities DMSs face in shaping and sustaining effective mathematics instruction at the district level.

Because DMSs represent a relatively small professional population compared to other educator groups (e.g., principals, teachers, school-based instructional coaches), the data are presented with careful attention to protecting respondent anonymity. At the same time, key findings are shared transparently to inform understanding of DMSs as a phenomenon and to contribute to advancing the field of mathematics leadership.

Descriptive Overview of DMSs' Roles and Context

Survey respondents represented 6 of 8 regions in the state and a variety of locales (see Table 1) with DMS positions varying widely in both title and scope. Some positions were content specific, with titles such as "administrator of mathematics" or "mathematics coordinator," and others spanned multiple content areas (e.g., "supervisor of mathematics, science and other programs," "instructional coordinator," "mathematics coordinator and division director of testing"). Nearly half the respondent positions (n = 14, 47%) supported mathematics across multiple grade bands, with the remaining respondents evenly split between early childhood and elementary positions (n = 8, 27%) and middle and high school positions (n = 8, 27%). Regarding longevity in a DMS position, survey participants represented a relatively inexperienced group of DMSs. Among the 30 respondents, years of experience ranged from 1–20+, with 20+ being an outlier. The mode was 2 years, and the median was 3 years. When asked about the number of schools they supported, DMSs reported a range from a small number of schools (< 5) to many schools (> 50), with a mean of 16.2, a mode of 2, and a median of 9. Notably, two thirds of the 30 respondents indicated they were credentialed as mathematics specialists by the state of Virginia.

Table 1
DMS Overview by Focus, Regions, Locales, Number of Participants, and Selected Titles

Grade band focus	Regions (1–8)	Locales	Participants (*n*)	Selected titles
PreK–12 or PreK–8	1, 2, 3, 4, 5, 6	City, rural, suburb	14	Administrator of mathematics; mathematics learning and school support specialist; coordinator of mathematics; supervisor of mathematics; supervisor of mathematics, science, and other programs; teacher specialist for mathematics
PreK/elementary (early childhood and elementary schools)	1, 2, 3, 4	City, rural, suburb, town	8	Instructional coordinator, instructional mathematics coach, mathematics coordinator, mathematics instructional specialist, mathematics specialist
Secondary (middle and/or high schools)	1, 3, 4, 5	City, rural, suburb, town	8	Mathematics coordinator, mathematics coordinator and division director of testing, mathematics specialist, supervisor of curriculum and instruction, supervisor of mathematics, PD specialist

Note. Locale information from "Locale Boundaries," by the National Center for Education Statistics, n.d. (https://nces.ed.gov/programs/edge/geographic/localeboundaries).

Responsibilities and Challenges of DMSs
Broadly, respondents indicated that they perceived supervisors and principals as emphasizing several key aspects of their roles. Most notably, DMSs reported that these leaders expected them to "lead professional development for mathematics teachers" (supervisors $n = 29$, 97%; principals $n = 27$, 90%), "interpret and support implementation of district or state mathematics standards" (supervisors $n = 28$, 93%; principals $n = 30$, 100%), and "model or demonstrate effective teaching practices" (supervisors $n = 27$, 90%; principals $n = 25$, 83%). These perceived expectations highlighted the central role of DMSs in translating district-level vision and policies into classroom practice and supporting teacher learning.

The following sections highlight DMSs' roles, responsibilities, and challenges. Respondents emphasized their central roles in supporting teachers, implementing curriculum, and translating district-level mathematics initiatives into classroom practice.

Supporting Teachers and Curriculum Implementation
DMS participants' primary focus centered on addressing teachers' instructional needs alongside curriculum planning, with most ($n = 24$, 80%) emphasizing their responsibility in supporting teachers' transitions to revised mathematics standards. Many DMSs ($n = 25$, 83%) also spoke of the desire to shift instruction toward more student- or problem-centered approaches to teaching because there were clear interests in students' learning (e.g., "developing mathematical knowledge," "supporting student fluency") and engagement with mathematics (e.g., "improve student love for mathematics"). The instructional needs identified by participants' responses were centered primarily on accelerated changes in standards, particularly rapid shifts in mathematical expectations. Participants emphasized helping teachers use district curriculum or pacing guides ($n = 30$, 100%) and aligning instruction with mathematics standards ($n = 28$, 93%). Many also focused on helping teachers understand why certain mathematical concepts were challenging for students ($n = 28$, 93%).

An important component of DMSs' responsibilities is visiting teachers' classrooms. These visits have a primarily formative purpose, designed to support DMSs in their work with teachers. Most respondents indicated the main goal of classroom visits was to gain a greater understanding of mathematics teaching and learning in the school ($n = 29$, 97%). In fact, there was a notably limited focus on the purpose of classroom visits for classroom management and student behavior ($n = 5$, 17%). Respondents' focus was how to bring a district- or state-level vision of mathematics instruction to life in the classroom by, as one PreK mathematics curriculum specialist described, "creating scope and sequence guides for new standards."

Challenges and Resource Needs
Respondents' challenges emphasized the dual responsibility of rapidly analyzing new standards while supporting classroom teachers with implementation. At the same time, they emphasized the importance of addressing structural changes at the district level. A respondent who worked as a PreK–12 instructional specialist explained:

> *Given both the upheaval of leadership at the district and changes due to implementation of new math standards,*

[my goals] are to support and advocate for teachers and students while preparing for standards implementation and trying to help new building- and district-administrators with structures to support the teaching and learning of mathematics.

This dual focus on teacher support and district-level structural changes reflected the challenges posed by leadership upheaval and the implementation of the newly revised mathematics standards.

Further, DMSs expressed the need for both material resources (e.g., funding, curriculum materials, manipulatives) and personnel support (e.g., additional teachers, professional learning opportunities, instructional coaches). Many DMSs discussed the need for creating "documents/activities updated for the new standards," as one secondary mathematics coordinator described, and "released test items to support teachers in understanding the [new standards'] rigor," as a PreK–12 mathematics specialist mentioned. Participants aimed to streamline processes and provide high-quality resources. One PreK/elementary mathematics instructional specialist described this approach as "aligned with the new curriculum" that another PreK–12 mathematics interventionist hoped "teachers can pull from instead of from [commercial resource deleted]." A PreK–12 administrator of mathematics hoped providing these resources would allow "time and space for educator learning," and a PreK–6 mathematics coordinator mentioned providing opportunities for "mentor and coaching support for teachers in mathematics instruction."

DMSs reported several challenges. Half the respondents (n = 15, 50%) discussed the need to build teachers' and principals' mathematical content and pedagogical knowledge, and others spoke to the challenges of time constraints (n = 16, 53%) and teachers' reluctance to change (n = 7, 23%). Nine respondents (30%) identified challenges stemming from district organizational structures (e.g., being the only district-level staff member responsible for mathematics improvement, managing responsibilities across multiple schools, adapting to a new role). Overall, these findings underscored DMSs' responsibility to balance curriculum implementation, teacher support, and district-level structural changes, navigating both logistical and instructional challenges while building capacity and preparing teachers and administrators to support effective mathematics instruction.

Influences on DMS Goal Setting

DMSs' goal setting was influenced by a combination of students' learning needs (e.g., "success of students"), teacher input and feedback (e.g., "[school-level] mathematics specialists and teachers"), and guidance from leadership (e.g., "principals and their goals for their staff") and supervisors (e.g., "the chief academic officer"). Of the 30 responses, 20 (67%) articulated goals shaped by division goals, initiatives, or data trends, and 18 (60%) articulated goals related to mathematics curriculum. About half (n = 14, 47%) indicated local, regional, or state policy issues (e.g., newly revised mathematics standards) and nearly one third (n = 8, 27%) indicated current research on mathematics teaching and learning influenced their goal setting.

Overall, these responses suggested planning for district-level, long-term mathematics goals is focused primarily on supporting teachers' understanding and implementation of standards-based instruction to enhance student learning. In setting these goals, participants appeared to balance multiple influences, including district leadership priorities and strategic initiatives (e.g., division goals, supervisor guidance); contextual insights from classroom observations and interactions with teachers and students; and their own professional knowledge, experience, and research-informed beliefs. Many respondents highlighted the importance of aligning goals with state standards and policy mandates while also responding to the needs of teachers and students in their schools. Taken together, these influences underscored the complex, multifaceted nature of DMS goal setting, which integrates top-down directives, local contextual factors, and the professional judgment of mathematics leaders.

Professional Learning and Support for DMSs

To understand how DMSs develop and maintain their professional expertise, it was important to consider both the informal and formal supports upon which they rely. The following subsections explored these supports, beginning with the sources of advice and guidance participants sought in their day-to-day work and followed by their participation in PD and the topics they prioritized for further learning. Together, these findings illuminated the ways participants accessed knowledge, collaborated with colleagues, and enhanced their instructional leadership.

Sources of Advice and Informal Support

The survey asked the DMS participants to identify to whom they turned for advice. Eighteen respondents (60%) indicated a mathematics supervisor, coordinator, specialist, or coach was their first choice for such advice. When asked to list up to three contacts upon whom they relied, four respondents (13%) included a principal or assistant principal, and 18 respondents (60%) mentioned an outside consultant (e.g., colleagues from other school districts). Interestingly, only two respondents (7%) cited a professional organization (e.g., NCSM, NCTM) as one of their top three sources of advice. Regarding the type of advice sought, participants most frequently reported guidance on lesson materials (n = 16, 53%), sharing activities or instructional resources (n = 18, 60%), and discussing instructional pacing for lessons or topics (n = 20, 67%).

Participation in PD

Among the additional research needs related to the responsibilities of DMSs is the need for their own ongoing professional learning (Baker et al., 2022; Cobb et al., 2018). Needless to say, access to PD is important. Survey respondents were asked to indicate how much time (in hours) they had spent as a participant in PD workshops or seminars in mathematics, mathematics education, or mathematics instructional coaching. Most respondents reported spending 16–35 hours (n = 10, 33%) or more

than 35 hours (n = 9, 30%) as a participant in such PD opportunities during the 2023–2024 school year. Four respondents (13%) participated in PD workshops or seminars in mathematics, mathematics education, or mathematics instructional coaching lasting less than 6 hours, and two respondents (7%) did not participate in any PD workshops or seminars.

Our survey included an item that led participating DMS respondents to consider "the extent to which they would like to receive professional development (PD)" in 18 different topics. In analyzing survey responses to the PD opportunities, we found the following opportunities received the most interest, defined in this study as 20 or more of the 30 respondents (66.6% or more) indicating a response of "a lot" or "a great deal" of interest in receiving PD on these topics (see Table 2).

Table 2
Most Interested DMS PD Topics

PD topic	*f* (%)
Current research on mathematics teaching and learning	21 (70%)
Strategies to engage all students in challenging, problem-solving tasks	21 (70%)
Designing challenging, problem-solving mathematics lessons with teachers	20 (67%)

Note. Questions taken from *Coach Survey,* by MIST, n.d. Peabody College, Vanderbilt University (https://peabody.vanderbilt.edu/academics/departments/teaching-learning/mist/instrument/).

These more popular PD opportunities included topics reflecting interest in research, reasoning, professional development, and mathematics content and pedagogy. We also recognized that when determining their levels of interest in the proposed PD opportunities, one third to one half of the 30 respondents indicated several of the PD opportunities were either of little interest to them, or they were not at all interested in these opportunities (see Table 3).

Table 3
Least Interested DMS PD Topics

PD topic	*f* (%)
Aligning state standards to the adopted mathematics textbook	15 (50%)
Theories of teacher (or adult) learning	13 (43%)
Supporting mathematics teachers in using the adopted curriculum	13 (43%)

Note. Questions taken from *Coach Survey,* by MIST, n.d. Peabody College, Vanderbilt University (https://peabody.vanderbilt.edu/academics/departments/teaching-learning/mist/instrument/).

These less popular PD opportunities reflected topics that respondents indicated having little or no interest in as professional learning opportunities and ranged from aligning state standards to the district's adopted mathematics textbook, the latter of which was the least popular PD opportunity. The less popular offerings also included, in addition to those noted previously, conducting small-group meetings to support instructional practices, understanding central mathematics ideas in the adopted curriculum, and modeling instruction for mathematics teachers.

Given the reality of limited daily contact with other DMS professionals as they engage in meeting the demands of their positions, research examining ways to provide regular access to PD opportunities that include time to interact with colleagues and address specific and important professional learning needs of DMS professionals must be considered.

DISCUSSION AND IMPLICATIONS

This exploratory study examined the roles, responsibilities, and professional learning needs of DMSs, particularly in relation to PD and curricular implementation. Its generalizability was constrained by several factors. The study was conducted in a single state with a small sample (n = 30). Diversity in respondents' roles (Greenes, 2013), responsibilities (Bolyard & Baker, 2025; Munter et al., 2023), and district locales may have influenced results. In addition, the sample likely excluded DMSs outside the professional organization through which the survey was distributed, potentially skewing perspectives toward those with organizational involvement.

However, we hypothesize that these findings on DMS roles, responsibilities, and professional learning needs may generalize to other regions or states, especially because the research surrounding DMSs has remained limited (Jackson et al., 2018; Lochmiller, 2015; Munter et al., 2023). All DMSs in this study were navigating recently revised mathematics standards and emphasized their central role in supporting teachers, implementing the mathematics curriculum, and translating district initiatives into classroom instructional practice. This finding aligned with prior research showing DMSs often encounter similar challenges during curricular transitions (Jarry-Shore et al., 2023), particularly when such transitions occur at the state level (Munter et al., 2023). The following sections examine these findings in greater detail, focusing on DMSs as system-level support leaders, their roles in promoting curriculum coherence during change, and their professional learning needs and opportunities.

DMSs as System-Level Support Leaders

The role of a DMS is complex and multifaceted (Bolyard & Baker, 2025) and is central to advancing PreK–12 mathematics teaching and learning in a school district (National Academies of Sciences, Engineering, and Medicine, 2024; Munter et al., 2023). Our findings, consistent with emerging research (Bolyard & Baker, 2025), indicated that participants described a broad set of responsibilities that directly or indirectly support PreK–12 teachers despite the lack of a uniform title for the DMS role. This diversity in titles and responsibilities reflects variation in district structures but can also complicate efforts to streamline resources and provide targeted professional learning for both DMSs and the educators they serve.

Consistent with previous research (Jackson et al., 2018; Kochmanski et al., 2025), DMSs in Virginia reported engaging in extensive work to support teachers, administrators, and broader educational communities. Their support extended well beyond classroom instruction: Participants described regularly collaborating with school-based and district administrators, communicating instructional expectations, interpreting policy, and guiding decisions related to mathematics curriculum and instruction. Through these activities, DMSs contribute to building coherent instructional systems and ensuring alignment between district and state priorities (Cobb et al., 2018; Jackson et al., 2018).

Participants also emphasized the importance of monitoring, documenting, and communicating the impact of their work—often through formal reporting to district leadership—to ensure their contributions were both visible and understood. Such communication is essential for maintaining ongoing support and for helping other district leaders recognize the scope and value of DMS responsibilities. Collectively, these activities highlighted the DMSs' critical roles in the districts' instructional infrastructure and their influence on a wide range of PreK–12 constituents, including students, families, community members, and local boards of education.

As districts continue to rely on DMSs for wide-ranging instructional and organizational support, it becomes essential to understand how these professionals allocate their time and what forms of support they provide to teachers, administrators, students, families, and community stakeholders. Their work often includes preparing and delivering professional learning, collaborating with mathematics specialists and department chairs, coplanning with teachers, and reviewing or analyzing curriculum materials. Yet, despite the centrality of these responsibilities, research on DMS roles has remained limited. Important questions persist: Who becomes a DMS? How are they appointed? How do they set short- and long-term goals? What is their typical tenure? Additionally, many DMSs assume responsibilities not highlighted often in the literature nor in our survey responses (e.g., formally observing and supervising mathematics teachers, managing district mathematics budgets). These duties can occupy substantial portions of their workweeks and raise further questions about the preparation, support, and resources DMSs receive to perform them effectively.

DMS Roles in Curriculum Change and System Coherence

In our exploratory study, DMS participants reported responsibility for advancing both short-term district goals (e.g., supporting revised mathematics standards implementation) and longer term priorities (e.g., implementing research-informed practices). Their survey responses showed how the state's newly revised mathematics standards shaped their daily work, reinforcing prior findings on the challenges of maintaining coherence during curricular change (Cobb et al., 2018). During this statewide transition, DMS participants concentrated on securing and vetting the resources teachers needed to implement the newly revised standards. Despite differing district budgets, participants noted similar instructional needs across contexts and stressed the importance of providing foundational tools (e.g., pacing guides, aligned lesson plans, coherent materials) before deeper instructional work could occur. In the absence of district-vetted resources, teachers may turn to external platforms such as Teachers Pay Teachers (n.d.), which can be misaligned with district expectations. This finding further illustrates the central role of DMSs in interpreting standards and translating them into usable instructional guidance (Clements, 2007; Jackson et al., 2018).

Participants also highlighted broader tensions associated with curriculum change. Consistent with Jackson et al. (2018), participants described friction between district emphases on instructional improvement and instructional management. Whereas curriculum departments prioritize pedagogical growth, central office leadership often focuses on compliance and timelines, creating misalignment that can complicate new initiatives and place DMSs in the difficult position of persuading teachers, principals, and district leaders to adopt shifting instructional expectations (Jackson et al., 2018). Further research could investigate DMSs' roles as boundary crossers whose work is to communicate mathematics priorities with other district leaders, school leaders, teachers, and community members. They work in a network of different interests and priorities for resources and information about mathematics teaching and learning.

To enact these responsibilities, DMS participants discussed monitoring district access to and use of high-quality instructional resources. Participants described evaluating the quality of print and digital materials, monitoring how frequently resources were used, and gathering information from teachers and students about the usefulness and impact of those materials. This work extended to analyzing student interest and achievement data to assess curricular effects, further illustrating the breadth of DMS responsibilities during periods of instructional change. Although the survey occurred early in the implementation of the newly revised standards, participants' emphasis on attending to standards and curriculum as "boundary objects" was not unique to this moment—it was a routine dimension of their role. Helping teachers interpret standards, anticipate instructional demands, and manage workload through clear pacing and resource structures remained consistent themes in their survey responses.

When discussing the challenges they faced, participants framed their responsibilities around four interconnected areas: (a) mathematics content (i.e., ensuring what is being taught aligns with standards); (b) pedagogy (i.e., supporting how instruction is delivered); (c) assessment (i.e., guiding how learning is evaluated); and (d) coherence across resources (i.e., ensuring alignment among lesson plans, curriculum maps, and instructional materials). This emphasis underscores DMSs' central role in sustaining coherent, standards-aligned mathematics instruction across their districts.

Given the complexity of curriculum-focused work and the pressures shaping DMSs' priority setting, our findings point to several needs. DMSs require structured opportunities to collaborate with peers within districts, across regions, and through professional organizations (e.g., NCSM, NCTM, AMTE) to share challenges, exchange strategies, and codevelop approaches to district- or state-level initiatives. Decisions about the structure, frequency, and facilitation of such collaboration are essential to ensuring sustained, meaningful support. As DMSs navigate both urgent and long-term curriculum-related pressures, these professional networks are critical for strengthening their capacity to lead coherent, research-informed instructional improvement across their districts.

Designing and Delivering Professional Learning Opportunities for DMSs

Surveyed DMSs identified several areas of professional learning they wished to explore, including current research on mathematics teaching and learning, strategies to engage all students in challenging problem-solving tasks, and designing mathematics lessons with teachers that incorporate such tasks. These results reflect the critical need for DMSs to remain informed about current research and to develop strategies for supporting teachers in designing and implementing high-quality mathematics instruction. Many DMSs occupy positions as the sole mathematics leader at the district level, though some districts include related leadership roles aligned to instructional levels (e.g., elementary and secondary mathematics supervisors). Regardless of district structure, regular opportunities for professional learning, mentorship, and peer support are essential for sustaining DMS effectiveness and reducing professional isolation. The sharing and codesign of tools and resources with leaders from other districts could also enhance curriculum coherence and statewide initiatives (Stephan et al., 2025).

The diversity of DMS participants' experiences highlights the ongoing need for professional learning tailored to individual and district contexts. Participants' shared interest in their own development suggests professional organizations can play a pivotal role in supporting these leaders as implementers and interpreters of changes and innovations in mathematics education. Ensuring equitable access to professional learning—including mentorship, networking, and varied delivery methods—may strengthen the capacity of DMSs to lead coherent, research-informed instructional improvement across districts.

Mentoring and structured support systems are particularly important for DMSs who are new to their roles. The continuing advancement of technology now enables easier sharing, collaboration, and creation of resources, making it possible for DMSs to connect even if they are physically isolated. Given the increase in access to technology in schools in response to the COVID-19 global pandemic, a unique opportunity exists to leverage these tools to better connect DMSs within and across states to address shared challenges. The facilitation of online professional development is crucial, as is the need to support DMSs in engaging in professional learning communities in a virtual environment. Doing so might allow DMSs to explore what others in their profession are doing and how aspects of this work may be shared. Further, a need exists for collaboration between DMSs and professional societies (e.g., NCSM, NCTM). Such collaborations can help meet DMSs' professional learning needs by increasing opportunities for dialogue and sharing successful strategies as well as common challenges. Exploring these avenues may allow DMSs to learn from one another and create a network that fosters continued growth and support.

CONCLUSION

In sum, this exploratory study accentuated the multifaceted responsibilities of DMSs, highlighting their central roles in supporting teachers; translating standards into practice; and sustaining coherence across curriculum, instruction, and assessment. Findings reveal that DMSs navigate tensions between instructional improvement and system management while addressing both short- and long-term district goals. Their work is shaped further by access to high-quality resources and the need for collaboration with peers and professional organizations to reduce isolation and share effective practices. Supporting DMSs through tailored professional learning, mentorship, and structured networks is critical to strengthening their capacity to lead research-informed instructional improvement. These insights point to the importance of continued research and targeted supports to enhance the effectiveness and sustainability of DMS leadership within complex educational systems.

ACKNOWLEDGMENT

This material is based upon work completed while Margret Hjalmarson served as a program officer at the U.S. National Science Foundation under the Independent Research & Development Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the U.S. National Science Foundation.

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APPENDIX A

The following survey incorporated items adapted from multiple sources, including Baker et al. (2022) and the Middle-School Mathematics and the Institutional Setting of Teaching (MIST, n.d.) Coach Survey, to gather information about DMS respondents' backgrounds, professional roles, and experiences supporting mathematics instruction.

Part I – Background Information

1. First name
2. Last Name
3. School District
4. Which region is your division located in? (*Region 1, Region 2, Region 3, Region 4, Region 5, Region 6, Region 7, Region 8*)
5. Official Title
6. How many years have you been serving in this role? Put a '1' if this is your first year.
7. How many schools do you provide mathematics support to?
8. What grade levels/bands are you **certified to teach mathematics**? Select all that apply. (Early Childhood, Elementary, Middle, High, Other – please provide)
9. In your role as a **mathematics leader,** what grade levels/bands **do you work with**? Select all that apply. (Early Childhood, Elementary, Middle, High, Other – please provide)
10. Are you credentialed/certified/endorsed by the state of Virginia as a mathematics specialist?
    a. Yes. Please indicate where certification/endorsement was received.
    b. No.
    c. Currently seeking certification as a mathematics specialist. (Please indicate where you are seeking certification/endorsement from.)

Part II – Participant Responsibilities

11. So far this school year (including Summer 2023), to what extent have you assisted mathematics teachers with the following? (Not at all, To a small extent, To a moderate extent, To a great extent)
    a. Clarifying the key mathematical ideas in a particular lesson or unit
    b. Understanding different ways in which students solve a particular problem
    c. Clarifying why certain mathematical ideas are difficult for students to understand
    d. Teaching mathematical ideas that are usually difficult for students to understand
    e. Acquiring materials related to mathematics instruction
    f. Implementing classroom-based formative assessment techniques (e.g., observations, interviews)
    g. Establishing classroom routines and procedures (e.g., collecting homework)
    h. Managing the behavior of specific students
    i. Matching the curriculum to the mathematics standards
    j. Using state test scores to improve instruction
    k. Planning for instruction
    l. Using the district's curriculum or pacing guide
12. So far this school year (including Summer 2023), have **you** provided any district-based professional development (workshops, seminars) to mathematics teachers? (Yes, No)
13. So far this school year (including Summer 2023), how much time in total hours have you spent **as a facilitator** for professional development workshops or seminars in mathematics, mathematics education or mathematics instructional coaching? (0, Less than 6, 6–15, 16–35, More than 35)
14. So far this school year (including Summer 2023), to what extent have you addressed the following topics when providing district-based professional development (workshops, seminars) for mathematics teachers? (Not at all, To a small extent, To a moderate extent, To a great extent)

   a. Meeting state standards or assessment requirements
   b. Managing the classroom and/or student discipline
   c. Analyzing students' mathematics work
   d. Deepening teachers' knowledge of mathematics
   e. Leading discussions in which students have to justify their mathematics solutions
   f. Understanding the central mathematical ideas in the curriculum
   g. Using challenging, problem-solving tasks
   h. Using strategies to engage all students in challenging, problems solving tasks
   i. Effectively using the adopted curriculum
   j. Understanding how student mathematical reasoning develops
   k. Planning and/or providing classroom instruction
   l. Planning and/or providing student intervention(s)
   m. Planning and/or providing teacher intervention(s)
   n. Planning and/or implementing family and community events
15. So far this school year (including Summer 2023), to what extent have you expected your mathematics teachers to do the following activities? (Not at all, To a small extent, To a moderate extent, To a great extent)
   a. Adhere to a prescribed pacing in their instruction
   b. Make sure their students' test scores improve
   c. Address the state/district objectives and standards
   d. Have whole classroom discussion in which students explain how they solved tasks
   e. Have small group discussion in which students explain how they solved tasks
   f. Use the adopted curriculum as a basis for their classroom instruction
   g. Keep students quiet and disciplined during classroom instruction
   h. Use challenging, problem-solving tasks with their students
   i. Use students' current mathematical thinking to inform their instruction
   j. Collaborate with other mathematics teachers
   k. Observe others' mathematics teaching
   l. Use me as a resource when instructional problems arise
   m. Make their lesson plans available for review
   n. Assist other mathematics teachers in improving their instruction
   o. Adjust instruction to meet the needs of low achieving students
16. Do you visit mathematics teachers' classrooms (Yes, No–Skip to Q18 if no)
17. To what extent do you agree or disagree with the following statement?: "My purpose in visiting mathematics teachers' classrooms is to . . ." (Strongly disagree, Somewhat disagree, Neither disagree or agree, Somewhat agree, Strongly agree)
   a. Assist them in improving their teaching
   b. Formally evaluate their teaching
   c. Gain a greater understanding of mathematics instruction in my school
   d. Monitor the extent to which teachers are using the adopted curriculum
   e. Monitor teachers' use of a particular instructional tool
   f. Monitor teachers to see if they are implementing an instructional strategy suggested in professional development
   g. Monitor teachers to see the extent to which formative assessment is a component of their planning and instruction
   h. Be visible in the school
   i. Support teachers with classroom management of student behavior
   j. Model instruction in mathematics
   k. Check on particular students' progress in mathematics
   l. Observe teachers with the purpose of providing feedback
18. To what extent are **you comfortable facilitating** professional development on the following topics: (Not at all, To a small extent, To a moderate extent, To a great extent)
   a. Interpreting state mathematics standards
   b. Aligning state standards to an adopted mathematics textbook
   c. Coordinating pacing of mathematics instructional units
   d. Current research on mathematics teaching and learning
   e. Facilitating teachers' analysis of students' mathematics work
   f. Conducting individual conferences with mathematics teachers focused on their teaching practices
   g. Conducting small group meetings of mathematics teachers to support the ongoing improvement of their instructional practices
   h. Deepening teachers' knowledge of mathematics
   i. Creating district formative assessments in mathematics
   j. Implementing classroom-based formative assessment techniques

   k. Fostering relationships of trust among mathematics teachers
   l. Supporting mathematics teachers in using the adopted curriculum
   m. Modeling instruction for mathematics teachers
   n. Designing challenging, problem-solving mathematics lessons with teachers
   o. Strategies to engage all students in challenging, problem-solving tasks
   p. Understanding how students mathematical reasoning develops
   q. Understanding the central mathematical ideas in the adopted curriculum
   r. Theories of teacher (or adult) learning
19. To what extent do **your supervisors** expect you to do the following things? (Not at all, To a small extent, To a moderate extent, To a great extent)
   a. Lead professional development activities for mathematics teachers
   b. Assist mathematics teachers in resolving student behavioral problems
   c. Observe mathematics teachers and provide feedback to improve teaching
   d. Examine students' mathematical work with teachers
   e. Hold grade-level or department meetings focused on mathematics instruction
   f. Help teachers understand how student mathematical reasoning develops
   g. Demonstrate effective teaching practices in mathematics
   h. Work with him/her/them to align curriculum with state standards
   i. Interpret district or state mathematics standards with teachers
   j. Communicate mathematics teachers' concerns to the principal
   k. Communicate mathematics teachers' concerns to district leaders
20. To what extent do **principals** expect you to do the following things? (Not at all, To a small extent, To a moderate extent, To a great extent)
   a. Lead professional development activities for mathematics teachers
   b. Assist mathematics teachers in resolving student behavioral problems
   c. Observe mathematics teachers and provide feedback to improve teaching
   d. Examine students' mathematical work with teachers
   e. Hold grade-level or department meetings focused on mathematics instruction
   f. Help teachers understand how student mathematical reasoning develops
   g. Demonstrate effective teaching practices in mathematics
   h. Work with him/her/them to align curriculum with state standards
   i. Interpret district or state mathematics standards with teachers
   j. Communicate mathematics teachers' concerns to the principal
   k. Communicate mathematics teachers' concerns to district leaders

Part III – Participant Professional Learning

21. So far this school year (including Summer 2023), how much time in total hours have you spent **as a participant** in professional development workshops or seminars in mathematics, mathematics education or mathematics instructional coaching? (0, Less than 6, 6-15, 16-35, More than 35)
22. To what extent would you like to **receive professional development** on the following topics: (None at all, A little, A moderate amount, A lot, A great deal)
   a. Interpreting state mathematics standards
   b. Aligning state standards to the adopted mathematics textbook
   c. Coordinating pacing of mathematics instructional units
   d. Current research on mathematics teaching and learning
   e. Facilitating teachers' analysis of students' mathematics work
   f. Conducting individual conferences with mathematics teachers focused on their teaching practices
   g. Conducting small group meetings of mathematics teachers to support the ongoing improvement of their instructional practices
   h. Deepening your knowledge of mathematics
   i. Creating district formative assessments in mathematics
   j. Implementing classroom-based formative assessment techniques and providing related feedback opportunities.
   k. Fostering relationships of trust among mathematics teachers
   l. Supporting mathematics teachers in using the adopted curriculum
   m. Modeling instruction for mathematics teachers
   n. Designing challenging, problem-solving mathematics lessons with teachers
   o. Strategies to engage all students in challenging, problem-solving tasks
   p. Understanding how students mathematical reasoning develops
   q. Understanding the central mathematical ideas in the adopted curriculum
   r. Theories of teacher (or adult) learning

23. During this school year (including Summer 2023), think about who you have turned to for advice or information about teaching mathematics. Please list the **role/position** of this person(s).
24. What types of advice or information do you seek from these individuals? Please check all options that apply.
    a. Doing mathematics problems together with discussions of different solution strategies
    b. Discussing different ways students are likely to solve tasks
    c. Discussing why some students didn't learn as expected in a lesson in order to plan for future instruction
    d. Analyzing examples of student work in order to adjust instruction
    e. Analyzing examples of student work to understand the different ways that students solve problems
    f. Analyzing student work to see if students "got it"
    g. Discussing how to make use of student solution strategies in whole class mathematical discussions
    h. Discussing pacing
    i. Discussing what materials to use for a lesson
    j. After a lesson, sharing whether students "got it"
    k. Sharing materials or activities
    l. Updating one another on a student or students' progress in mathematics
    m. Other – Please list:
25. How often do you seek advice? (*Daily or almost daily, Once or twice per week, Once or twice per month, A few times per year*)
26. Overall, how influential is the advice you received? (Not at all, Somewhat, Very)

Part IV – Participant Implementation of District Initiatives

27. In your district, who are the math leaders in the **elementary schools** that support the implementation of district initiatives?
    a. Classroom teachers
    b. Math lead or Department chair
    c. Math coaches
    d. Instructional coaches
    e. Principals
    f. None
    g. Other – Please list:
28. In your district, who are the math leaders in the **middle schools** that support the implementation of district initiatives?
    a. Classroom teachers
    b. Math lead or department chair
    c. Math coaches
    d. Instructional coaches
    e. Principals
    f. None
    g. Other – Please list:
29. In your district, who are the math leaders in the **high schools** that support the implementation of district initiatives?
    a. Classroom teachers
    b. Math lead or department chair
    c. Math coaches
    d. Instructional coaches
    e. Principals
    f. None
    g. Other – Please list:

Part V – Open-Ended Response

30. As a district leader, what are your **current or short-term goals** this year (2023–2024)?
31. As a district leader, what are your **long-term goals** for the next 3–5 years?
32. What or who **influences** your goal setting?
33. What are the **challenges** you face as a district leader?
34. What are the **instructional** needs of your school district?
35. What are the **resources** needed in your school district?
36. Would you be willing to participate in a follow-up interview? (Yes, please provide an email address, No)