

MATHEMATICS SPECIALISTS AND TEACHER LEADERS: AN ONGOING QUALITATIVE SYNTHESIS

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Mathematics specialists are sometimes known as math coaches, mathematics teacher leaders or other titles. The definition in this paper is a facilitator or leader of teachers focused on professional development in mathematics. The focus of this qualitative synthesis of the literature is to investigate how this role has been studied, defined, and investigated. This preliminary analysis has documented the research methods used in studies, examined the focus of studies, and raises questions about the different types of teacher leadership that may exist.

Keywords: Elementary School Education, Instructional Leadership, Teacher Education - Inservice / Professional Development, Research Methods

The term mathematics specialists were first introduced as a concept in an editorial in *Teaching Children Mathematics* (Dossey, 1984). However, research about mathematics specialists was dormant for a few decades following that call to action until the early 2000s. McGatha and Rigelman (2017) offer a framework that organizes terminology for the different roles that might fall under the umbrella term of mathematics specialist. One set of responsibilities involve the mathematics specialists as professional development facilitator or leader of teachers. A second set of responsibilities involves their work teaching mathematics to students either as a teacher whose primary content to teach is mathematics or as a teacher who might work with small groups of students who need focused instruction in mathematics. We frame these as “responsibilities” because many mathematics specialists have multiple types of responsibilities. For example, the mathematics resource teacher might work with small groups of students in need of extra mathematics support but could also be called on to facilitate lesson study with grade-level teams of teachers. The collection of roles and responsibilities is more like a terrain of options than a set of discrete categories.

Recommendations for professional development for teachers consistently point to needing ongoing, school-based support for mathematics (Darling-Hammond, Hyler, & Gardner, 2017; Woulfin & Rigby, 2017). Models such as lesson study, professional learning communities (PLC), math labs or individual coaching often include a facilitator, coach or specialist at some stage. For instance, a math coach might be assigned at a school to work with all first-grade teachers in a PLC to provide additional knowledge and expertise in mathematics. Their role in that PLC might vary over time and the math coach may work with a different grade-level PLC the following year. However, that role is under-investigated in the research, but studies are emerging about the knowledge and skills required. As such, this paper presents early findings and a preliminary report to raise questions from existing research about mathematics specialists.

Purpose

The purpose of our work is to synthesize existing research and develop understanding of the positioning of mathematics specialists and teacher leaders in the research. Our focus in this analysis is on the mathematics specialists as supporting teacher professional development and not on their work as teachers. We ground our definition in Campbell and Malkus (2013) in recognizing that a mathematics specialist is an on-site support person whose uses knowledge and expertise in mathematics content, pedagogy, and children's learning trajectories to assist teachers with their content, pedagogy, and understanding of children's learning trajectories. While many mathematics specialists are primarily teachers of mathematics, the role should be of interest to mathematics education because of its potential to provide school-based professional development. In this study, we seek to identify patterns and trends in research about mathematics specialists in schools. Our goal is to both create a framework for their roles and responsibilities and to describe how that research has been conducted to gather evidence regarding the complexity of the roles and responsibilities of mathematics specialists. Our purpose is to recommend future directions for research about mathematics specialists and to synthesize what is already known.

Methodology

We have begun working through the stages of qualitative synthesis suggested by Thunder and Berry (2016). The first step was to create criteria for the studies, identify the databases and develop a list of search terms. Each member of the team was responsible for selecting a database for the set of search terms. Then, we aggregated the list across those databases. Our first step was to eliminate pieces that were not articles (e.g., book reviews) and then to eliminate irrelevant articles (e.g., from fields outside education, focused on athletic coaching). For relevance, we included articles focused on mathematics and education. We coded articles that were clearly about mathematics specialists as MC, ADMIN for those regarding school leaders, PD for papers about professional development, and PST for articles about pre-service teachers; some articles were coded with multiple codes. In the portion of the review presented here, we have also pared down the list to identify those articles that mention math specialists (or related terms) in the title or the abstract, and thus coded MC. These articles have the greatest potential to provide insight about mathematics specialists. Later work may investigate how math specialists might appear in other parts of the publications.

Results

Overall, we can see that there has been an increasing trend in research that has been published about mathematics coaches and specialists between our target years of 1991-2018 (see Figure 1). Furthermore, we see the largest spikes in year-to-year publications between 2015-2016 (+7), 2002-2003 (+5), 2009-2010 (+5), and 2016-2017 (+5). Some of these spikes seem to be related to NCTM's release of Research Briefs in 2009 and 2015.

Wanting to better understand broad methodological trends for our 192 publications about mathematics coaches and specialists, we read through the abstracts and methods sections to identify the methods used in each study. As illustrated in Table 1, 72 studies utilized qualitative methods, 48 used mixed methods, and 23 employed quantitative methods. Furthermore, we identified 34 articles that had been published in practitioner journals, and given that they did not have discernable methods, we did not code for methods in this group. Last, we identified 14 items, including book chapters, editorials, and literature reviews that – similar to the practitioner pieces – did not have a discernible method. Thus, we simply coded these as Other. At this point, we are still including them in our database because we are interested in portrayals of the role of the mathematics specialists and different perspectives on the topic. So, while they may not be empirical research, they may still have something to offer in learning more about the work in practice and how it has changed over time.

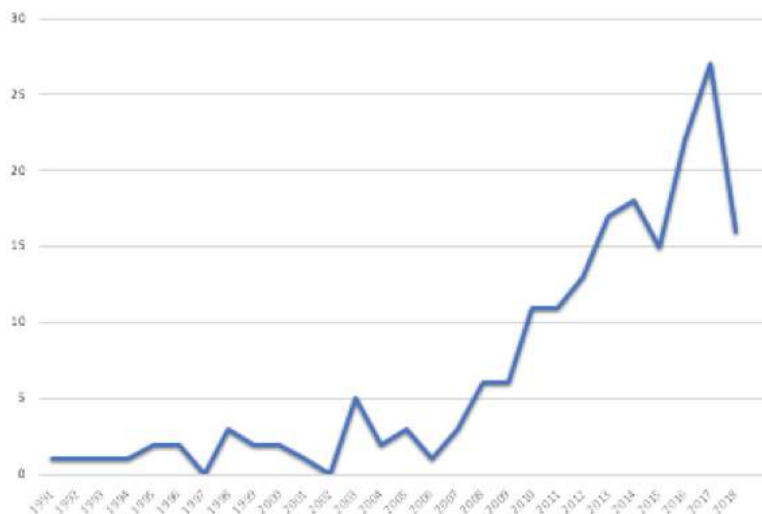


Figure 1. Overall Trends from 1991-2018

Last, and as previously mentioned, we read through the abstracts and assigned at least one of the following codes based on what the article was about: MC (Mathematics Coach), PD (Professional Development), PST (Pre-service Teacher), ADMIN (Administrator). Frequencies for each individual category and overlapping categories can be found above in Table 1.

Table 1. Methodology and Abstract Topic Frequency

| Method | Frequency |
|-----------------------------|------------------|
| Qualitative | 72 |
| Mixed | 48 |
| Practitioner | 34 |
| Quantitative | 23 |
| Other | 14 |
| Combination of Codes | Frequency |
| MC (only) | 95 |
| MC, PD | 57 |
| MC, ADMIN | 19 |
| MC, PD, ADMIN | 8 |
| MC, PST | 8 |
| MC, PD, PST | 5 |
| MC, PD, ADMIN, PST | 1 |

Discussion

We are encouraged by the number of studies focused specifically on mathematics specialists and the increasing focus on their work, knowledge, and roles as distinct from other roles in schools. It is not surprising that research about them is likely intertwined with studies of teachers and administrators as their work is designed to include these groups. We are also encouraged to see the variety of methodological approaches that have been used as this will provide a richer and more nuanced understanding of the different types of work mathematics specialists do and its impacts on teaching and learning mathematics.

In narrowing a list of thousands of articles down to a shorter list, we encountered questions about what to eliminate and what articles to keep for our review. Some eliminations were clear (e.g., when the study is in a different field than education), but some questions have been more complicated. Two groups of questions include: (a) determining what makes a study have enough mathematics education to warrant further investigation and (b) considering mentoring pre-service teachers.

The first question we needed to consider was: *What is enough mathematics for a study to be about mathematics teaching and learning?* This may not seem like a complex question, but is complicated when attempting a large synthesis study. The first aspect is when mathematics achievement is used as a student outcome but the abstract does not include discussions of mathematics-focused interventions. Such studies may provide other academic supports for students, but are not focused on mathematics specifically. The second type of ambiguity is when it is not clear the professional development is focused on teaching in mathematics context. We felt only having a mathematics outcome variable was insufficient for inclusion when the intervention was focused on other aspects of teaching and learning. The second question we needed to consider was: *How similar or different the role of mentor teacher is from the role of a math coach?* A collection of studies that emerged focused on mentors of pre-service teachers. We have not yet answered the question posed. A math coach also does one-to-one work with teachers (e.g., co-planning lessons, observations, co-teaching), but mentoring a pre-service teacher may have different features. Both may fall under the broad category of mentoring, but we are not sure yet if mentoring pre-service teachers needs to be analyzed independently from other types of coaching or peer mentoring among teachers.

In addition to the two questions, we also note considerations in regard to abstracts. The first consideration involves the term mathematics specialists being included in the abstract. We have narrowed our list of articles down to 192 that, based on the abstracts, are investigating some aspect of math coaching work. However, there are hundreds more that do not mention that role in the abstract. This supports our claim at this point that mathematics specialists continue to be “hidden players” (Hjalmarson & Baker, 2020) in the research about mathematics specialists. “Hidden” in the present synthesis means that in studies of professional development, the role of the person who might be facilitating the professional development continues to be unmentioned or vague. The second consideration involves the need for more comprehensive, clear, or structured abstracts (Kelly & Yin, 2007) that describe the major aspects of studies (e.g., questions, research design, participants). Some journals already require such abstracts (e.g., *Journal of Engineering Education*). In terms of stakeholders or participants in teacher professional development studies, abstracts could include more about the facilitators of such experiences.

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