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We Need Elementary Mathematics Specialists Now, More Than Ever: A Historical Perspective and Call to Action

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In early June 2010, the Common Core State Standards (CCSS) were released. One year later, 45 of this country's states have agreed to adopt the Common Core and are transitioning to these new mathematics standards. One could argue that the adoption of the CCSS for Mathematics has, to a great extent, altered the daily responsibilities for many elementary mathematics specialists. In many schools and districts, elementary mathematics specialists have become the "go-to" people with regard to everything having to do with the CCSS for Mathematics, including what the Standards for Mathematical Practice are intended to look like in classrooms, what the Mathematical Content Standards mean and how they are woven together, what professional development might be needed for teachers and administrators, how parents might be informed and involved, as well as what the Partnership for Readiness for College and Careers (PARCC) or Smarter Balanced Assessment Consortium (SBAC) assessments are likely to contain. Elementary mathematics specialists have also become responsible for knowing about resources available to support the implementation of the CCSS for Mathematics, including the materials posted to the Tools for the Common Core Standards (http://commoncoretools.wordpress.com/) where the Progressions documents can be found, where a tool for analyzing curriculum materials can be accessed, and where the Illustrative Mathematics Project and other related efforts can be explored. In other words, elementary mathematics specialists are becoming the school or district level "transition agents" for the Common Core State Standards for Mathematics. Mathematics specialists at the elementary school level are becoming increasingly important as we acknowledge the complexities of elementary mathematics teaching and learning. But how did this all get started, anyway? Calls for mathematics specialists, mathematics coaches, or elementary mathematics instructional leaders are certainly not new to the mathematics education community.

A Brief History of Calls for Elementary Mathematics Specialists

The departmentalization of elementary schools was very popular in the 1960's and early 1970's but was suggested as early as the 1920's in an effort to ensure that content-focused teachers taught all of the mathematics (or science or social studies) at a particular grade, typically Grades 4 through 6 (Becker & Gleason, 1927). During the 1970's, projects like the Developing Elementary Mathematics Enthusiasts (DEME) Project were created to identify building-based mathematics "enthusiasts" who cared enough about the importance of mathematics to assist their colleagues by serving as afterschool and beforeschool mentors and generally providing the math support for the building (Fennell, 1978). In 1981, the National Council of Teachers of Mathematics (NCTM) recommended that state certification provide for a teaching credential endorsement for elementary mathematics specialists. Then, in 1984, NCTM President John Dossey called for elementary mathematics specialists in an article in the *Arithmetic Teacher* (Dossey, 1984). From these early beginnings, the importance of the mathematics specialist role began to emerge.

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While mathematics educators have advocated for elementary mathematics specialists for over three decades (Fennell, 2006; Lott, 2003), the ExxonMobil Foundation deserves much credit for shaping the role of elementary mathematics specialists and supporting the teachers who took on these leadership roles. When the Foundation's mathematics education program began in 1987, one of its goals was to support the use of mathematics specialists in the primary grades (Miller, Moon, & Elko, 2000). Most of these ExxonMobil Elementary Mathematics Specialist Projects provided professional development support for elementary mathematics specialists by deepening their mathematical knowledge for teaching, exploring learning theory, providing opportunities to examine and discuss curriculum materials, and considering a range of issues related to mathematics instruction and assessment. This work included opportunities involving curriculum and curriculum materials, learning theory, assessment and instruction. Bob Witte and Jean Moon were largely responsible for these pioneering efforts, and even today, the Foundation continues to support initiatives in support of mathematics specialists in areas of the country where ExxonMobil has a significant corporation presence.

Recommendations about the need for elementary teachers with interest and expertise in mathematics continued to appear in a range of publications. For instance, the National Research Council's Everybody Counts (1989) noted the following:

> *"The United Sates is one of the few countries in the world that continues to pretend – despite substantial evidence to the contrary – that elementary school teachers are able to teach all subjects equally well. It is time that we identify a cadre of teachers with special interest in mathematics and science who would be well prepared to teach young children both mathematics and science in an integrated, discovery-based environment." (p. 64)*

The *Principles and Standards for School Mathematics* (NCTM, 2000) suggested that specialist-related models, including mathematics teacher leaders and mathematics specialists, be considered as a way to ensure the mathematical expertise of those responsible for knowing and teaching the content and process standards contained within the *Principles and Standards* and thereby strengthen and deepen the mathematics learning of students. *Adding it Up* (NRC, 2001) also discussed mathematics specialists within a departmentalized setting (e.g., one teacher teaching all the Grade 4 mathematics) as well as describing school-based mathematics specialists who could be responsible for supporting mathematics teaching and learning in one or more buildings by coaching/mentoring teachers, providing professional development, co-teaching mathematics lessons, or providing intervention or enrichment through "pull out" programs. A Report from the Conference Board of the Mathematical Sciences entitled *The Mathematical Education of Teachers* (CBMS, 2001) called for efforts to strengthen the mathematics preparation of *all* elementary teachers but also recommended that all mathematics in Grades 5 - 8 be taught by mathematics specialists. It should also be noted that the *No Child Left Behind* legislation signed in 2001 and implemented in 2003, requiring the annual reporting of annual Adequate Yearly Progress (AYP) data for mathematics and reading, has prompted many schools and districts to identify elementary mathematics specialists, elementary mathematics coaches, and mathematics instructional leaders as part of an effort to increase the mathematics performance of their students on state assessments.

Unfortunately there is currently little quantitative data to support the use of elementary mathematics specialists, elementary mathematics instructional leaders, or elementary mathematics coaches to strengthen mathematics teaching and learning at the elementary grades (NCTM, 2009). However, in her research brief for the National Council of Teachers of Mathematics on elementary mathematics specialists and coaches, McGatha (NCTM, 2009) noted that while research on the teacher leader model of the mathematics specialist is, for the most part, nonexistent, Gerretson, Bosnick, and Schofield (2008) found that using elementary mathematics lead teachers to focus only on mathematics instruction allowed them to have more time for planning and allowed them to focus their professional development. In addition, descriptive data and anecdotal evidence suggest that such individuals can have a positive impact on the mathematics performance of a school or district. The National Mathematics Advisory Panel report (2008) recommended that "research be conducted on the use of full-time mathematics teachers in elementary schools" (page xxii). This recommendation was based on the Panel's findings relative to the importance of teacher content knowledge and their recognition that most preservice teacher education programs for elementary teachers do not address the teaching of mathematics in sufficient depth. It is well known that mathematics-related coursework at the preservice level is typically limited to two mathematics

courses and one course related to the teaching of mathematics (Karp & Fennell, 2010). Despite the lack of research, many schools, districts, and even states continued to pursue the use of mathematics specialists as a way to address the need to strengthen student performance in mathematics.

State-Level Efforts to Support Elementary Mathematics Specialization

As interest in elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders grew, states began to take notice. Maryland's *Keys to Math Success – A Report from the Maryland Mathematics Commission* (MSDE, 2001) used suggestions from the *Principles and Standards for School Mathematics* (NCTM, 2000), *Adding it Up* (NRC, 2001) and the *Mathematical Education of Teachers* (CBMS, 2001) to help justify their recommendation that certification for elementary mathematics specialists be pursued. The Maryland report is not unique, as other state reports have also advocated for elementary mathematics specialist certification. That said, at a time when virtually every state offers certification for reading specialists, fewer than fifteen states have actually enacted certification for elementary school mathematics specialists. At present, the following states have developed certification guidelines for elementary mathematics specialists: Arizona, California, Georgia, Maryland, Michigan, North Carolina, Ohio, South Dakota, Texas, Utah, and Virginia with Kentucky, Louisiana, Wisconsin, and probably others to soon formally become "members" of this expanding network of states that acknowledge state certification for mathematics specialists. See the Elementary Mathematics Specialists and Teacher Leaders website at http://www.mathspecialists.org for a review of all state certifications for elementary mathematics specialists.

At present, Virginia is the only state that requires certification and a Master's Degree for elementary mathematics specialists. The Virginia program, established in 2007 and supported by the National Science Foundation, is directed and led by Virginia Commonwealth University. This state initiative includes a core of mathematics and mathematics education courses leading to elementary mathematics specialization that participating colleges and universities have all agreed to offer. In addition, the research component of the Virginia initiative is often referenced, as it tracks the role and responsibilities of elementary mathematics specialists, and the impact of their work on student achievement (Campbell, 2009; Campbell & Markus, 2009, 2011).

In recent years the Association of Mathematics Teacher Educators adopted guidelines (AMTE, 2009) for teacher credentialing and degree programs and the National Council of Teachers of Mathematics (NCTM), the National Council of Supervisors of Mathematics (NCSM), the Association of Mathematics Teacher Educators (AMTE) and the Association of State Supervisors of Mathematics (ASSM) have issued the following joint position statement (NCTM, 2010):

> *The AMTE, ASSM, NCSM, and NCTM recommend the use of Elementary Mathematics Specialists (EMS professionals) in pre-K–6 environments to enhance the teaching, learning, and assessing of mathematics to improve student achievement. We further advocate that every elementary school have access to an EMS. Districts, states or provinces, and institutions of higher education should work in collaboration to create (1) advanced certification for EMS professionals and (2) rigorous programs to prepare EMS professionals. EMS professionals need a deep and broad knowledge of mathematics content, expertise in using and helping others use effective instructional practices, and the ability to support efforts that help all pre-K–6 students learn important mathematics. Programs for EMS professionals should focus on mathematics content knowledge, pedagogical knowledge, and leadership knowledge and skills.*

Unfortunately it is far too often the case that many elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders are appointed to such positions without elementary mathematics specialist certification or without even the proper vetting related to their content, pedagogical, and leadership knowledge and skills. For instance, a survey of Maryland school districts (Ruehl & Wray, 2009) found that many districts employed literally hundreds of mathematics specialists, elementary mathematics coaches, and mathematics instructional leaders. This might have been due to increasing need for such specialists given the pressure to produce gains in mathematics performance in order to show Adequate Yearly Progress (AYP).

Now that many districts and states are transitioning to the Common Core Standards for Mathematics (CCSSO, 2010), the need for these elementary mathematics leaders has increased even further. As discussed earlier, elementary mathematics specialists in schools and districts have become the transition agents for the Common Core State

Standards for Mathematics, working with teachers to consider the Standards for Mathematical Practice and the shift in mathematics content standards—both of which require that teachers have a deeper understanding of what it means to do and learn mathematics—as well considering how these practices and content may be assessed through the Partnership for Readiness for College and Careers (PARCC) or the Smarter Balanced Assessment Consortium (SBAC). The work of these elementary mathematics specialists will continue to be important and leads to an

Table 1

MATHEMATICS SPECIALISTS MILESTONES	
1984	NCTM Recommends State Certification Endorsement for Elementary Mathematics Specialists
1987	Exxon Foundation's support of K-3 Mathematics Specialists
1989	Everybody Count's support for specialization in mathematics at the elementary school level
2000	NCTM's *Principles and Standards for School Mathematics* suggests exploration of models for elementary mathematics specialists and teacher leaders
2001	CBMS' *The Mathematical Education of Teachers* recommendation that mathematics in the middle grades should be taught by mathematics specialists, starting at least in the 5th grade.
2001	*Adding it Up*'s review of the need for mathematics specialists
2001	PL 107-110 the *No Child Left Behind Act*
2003	NCTM President's Message: *The Time Has Come for Pre-K-5 Mathematics Specialists* – Jonny Lott
2006	NCTM President's Message: *We Need Mathematics Specialists NOW!* – Francis (Skip) Fennell
2007	Virginia Commonwealth University, Virginia Science and Mathematic Coalition – Virginia Mathematics Specialist Project
2008	National Mathematics Advisory Panel Recommendation – Elementary Mathematics Specialists
2009	Elementary Mathematics Specialists and Teacher Leaders Project established at McDaniel College
2009	AMTE Standards for Elementary Mathematics Specialists
2010	NCTM, NCSM, AMTE, ASSM – Joint Position Statement – The Role of Elementary Mathematics Specialists in the Teaching and Learning of Mathematics
2010	Common Core State Standards released
2011	45 States Transition to the CCSS and PARCC and SMART consortial assessments

obvious question: "What is it that elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders actually do?"

Elementary Mathematics Specialists: What Do They Do?

A wide variety of position titles may be used in association with an elementary mathematics specialist role. These include: elementary mathematics coach, elementary mathematics instructional leader, mathematics support teacher, mathematics resource teacher, mentor teacher, and lead teacher. There may be other position titles as well. The roles and responsibilities associated with these position titles can also vary widely depending upon the particular context of the position (Miller, Moon, & Elko 2000). More important than the actual position titles, however, are the expectations for the position. An analysis of a variety of elementary mathematics specialist initiatives suggests the following responsibilities for those who serve in an elementary mathematics specialist role at either the school or district level.

- **Mentoring/Coaching.** Many elementary mathematics specialists spend much of their day working with other teachers in one or more schools. Such mentoring or coaching often focuses on mathematics content and pedagogy and includes the following: co-planning mathematics lessons with teachers; working with teachers to identify important instructional needs; co-teaching mathematics lessons with teachers; assisting with the monitoring of student progress; and debriefing with teachers to discuss the impact of lessons that were co-planned and co-taught.

- **Providing Professional Development.** Increasingly, many elementary mathematics specialists are planning and facilitating school-based or district-wide professional development in mathematics, especially given the transition to the Common Core State Standards for Mathematics and the limited funding for professional development in so many districts.

- **Assisting with Curriculum and Instruction.** Elementary mathematics specialists may work at the school and district level to align curriculum frameworks, link instructional materials to important standards, interpret the literature on "best practices" and the research on the teaching and learning of mathematics with colleagues, and address any school and district needs.

- **Coordinating Interventions.** Some elementary mathematics specialists are responsible for coordinating and implementing intervention programs in mathematics. These may be in-class interventions, where the elementary mathematics specialist assists the classroom teacher to address the needs of struggling students. Alternatively, this may be outside-of-class Tier 2 and Tier 3 interventions associated with Response to Intervention (RTI) initiatives.

- **Supporting Professional Learning Communities.** Perhaps one of the most important goals of any elementary mathematics specialist is to provide the kinds of supports that contribute to the establishment of professional learning communities within schools—communities that truly foster a self-reflective culture of learning among teachers (Moon, 2002). These communities can help extend the support provided by the elementary mathematics specialists as colleagues begin to take on responsibilities for their own learning and begin to share aspects of their own practice.

Elementary mathematics specialists are not likely to be expected to engage in the evaluations of teachers or complete any paperwork associated with teacher evaluations. However, many elementary mathematics specialists regularly work with their teacher colleagues as they prepare for aspects of the teacher evaluation process including any formal classroom observations associated with the process. They may also work closely with teacher colleagues to address needs identified by school administrators during the evaluation process.

Another consideration associated with the expectations for the elementary mathematics specialist position has to do with the funding source. Those supported by Title I funding or even special education funding are more likely to have teaching or assisting students as part of their specialist responsibilities. This may also include co-teaching, with a particular emphasis on assisting Title I students or those with an Individualized Educational Plan (IEP), or perhaps being responsible for organizing and implementing "pull out" programs for students with these needs. Those supported with other funding may be more likely to have responsibilities that involve more support for teachers. Sometimes positions are funded through a variety of funding programs, thus creating positions that involve a mix of direct services to students and support for teachers.

How Do We Know This is Working? A Challenge for the Field

As noted earlier, there is little quantitative data measuring the impact of elementary mathematics specialists on student performance in mathematics. This poses a significant challenge to schools and school districts that have funded and filled these kinds of positions. What kind of data might be important to collect? How long would it take for a school's achievement in mathematics to reflect the influence of a school-based mathematics leader?

While research related on the impact of mathematics specialists, instructional leaders, and mathematics coaches is extremely limited, data continues to emerge, and there is reason to believe that mathematics specialists can help teachers in making significant changes in their instructional practices and that these leaders have a positive impact on the instructional practice of teachers with whom they work. Several researchers (Rowan & Campbell, 1995; Campbell, 2007; Campbell and Malkus, 2009, 2011; Erchick et al., 2007) have been at the forefront of examining the impact of elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders on the mathematics achievement of students. While the causality issues here are complicated, there are some issues to consider. Just hiring an elementary mathematics specialist is not a "quick fix" with regard to improving a school's mathematics performance—no surprise there. Achievement gains may not be immediate and may vary across grade levels. Other intervening factors, like the time allotted to mathematics instruction, may also have an impact on student performance. In the meantime, it is hoped that research will consider a broad range of outcomes related to aspects of an elementary mathematics specialist's responsibilities.

A Resource: The Elementary Mathematics Specialists and Teacher Leaders Project (ems&tl)

The Elementary Mathematics Specialists and Teacher Leaders Project (ems&tl), established in 2009 at McDaniel College in Westminster, MD and supported by the The Brookhill Foundation, is dedicated to serving the needs of elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders. The project includes the following components:

a. A national clearinghouse that addresses the growth, development, and ongoing needs relative to elementary mathematics specialists;

b. Collaborative work with a core group of elementary mathematics specialists from central Maryland with a focus on the development and review of the project's case-based work.

c. Professional development for mathematics specialists —both locally and nationally, through the National Council of Supervisors of Mathematics' (NCSM) leadership conferences, prior to National Council of Teachers of Mathematics regional conferences, and during the NCSM Summer Leadership Academy.

d. Access to indicators of the impact of the work related to mathematics specialists at the regional and national level through the study of course offerings at the college/university level; review of state certification efforts; and analysis of school and school district programs that involve specialists, with particular attention to student achievement and teacher background.

The ems&tl Project regularly updates its national clearinghouse website. The website, located at http://mathspecialists.org, has received well over 200,000 hits and includes the following sources of information relative to the work of the elementary mathematics specialists: school district-based initiatives which involve elementary mathematics specialists; college and university graduate level programs for mathematics specialists; state certification guidelines for elementary mathematics specialists; publications ranging from texts to testimonies; and a discussion forum which includes "This Worked!" activities for elementary mathematics specialists. If you have not yet visited this site, we encourage you to do so—it's for you!

Moving Forward

For over three decades elementary mathematics specialists, elementary mathematics coaches, and elementary mathematics instructional leaders have been suggested as a possible solution (or step along the way) to ensuring strong mathematics teaching practice and higher student achievement in mathematics. There is enough history and acknowledgement to finally say, this 'seems like a good idea,' now lets move forward!

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