

VIRGINIA MATHEMATICS AND SCIENCE COALITION  
MIDDLE SCHOOL MATHEMATICS SPECIALIST  
TASK FORCE REPORT  
March 15, 2009

The Virginia Mathematics and Science Coalition (VMSC) formed a task force in the spring of 2008 to study the role and responsibilities of Middle School Mathematics Specialist. An earlier task force commissioned in 2002 had reported on the job description, competencies, preparation and licensure of Mathematics Specialist at both the elementary and middle school levels. The Virginia Department of Education also recognized the important role that Mathematics Specialists play at both the elementary and middle school level and created a K-8 Mathematics Specialist endorsement. Several National Science Foundation Mathematics and Science partnership grants have allowed Virginia universities and school divisions to develop content courses and leadership courses for Mathematics Specialists. The initial focus of this work was on the preparation of Elementary Mathematics Specialists. In a review of the current Mathematics Specialist Program, the VMSC recognized that more attention needed to be given to the work of Middle School Specialists since their work requires a set of skills and competencies that differ from that of Elementary Specialists. The Coalition surmised that the mathematical content knowledge, pedagogy and organizational structure of middle schools were significantly different than that of elementary. Due to these concerns, the 2008 Middle School Mathematics Specialist Task Force was formed to address the following goals:

- Define the role and responsibilities of Middle School Mathematics Specialists.
- Identify the knowledge and competencies needed for a Middle School Mathematics Specialist to be successful.
- Describe what the preparation of Middle School Mathematics Specialists should involve, including work with principals, supervisors and other instructional staff.
- Explain how the role of a Middle School Mathematics Specialist can compliment and enhance the organizational structure of a school and school division.
- Describe ways to sustain a successful Middle School Mathematics Specialist program.

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***Virginia Mathematics and Science Coalition Middle School Mathematics Specialist  
Task Force Executive Summary  
March 15, 2009***

As the world economy struggles with the impact of a recession, the educational system in the United States is under increasing pressure to offer programs for all students that will provide them with 21<sup>st</sup> Century skills that allow them to be the leaders and innovators of tomorrow. Mathematical proficiency is a critical component of a strong education. Every student must have an equal opportunity to engage in mathematics instruction that helps them understand concepts, gain efficiency with procedures, learn to reason logically and flexibly apply their mathematical knowledge in new problem-solving situations. To offer exemplary instruction, teachers must be confident in their own mathematical abilities. Experts in mathematical teaching and learning, Mathematics Specialists, are needed to support this work.

In Virginia, Elementary Mathematics Specialists have made a difference in student learning since the establishment of a State licensure for Mathematics Specialists and the creation of a coordinated preparation program for these specialists. Now the focus of the VMSC has turned to the specific needs of middle school students. Current international studies show substantial gaps between U.S. 8<sup>th</sup> graders and their counterparts in other advanced countries. Federal No Child Left Behind (NCLB) legislation requires that all students, in all representative subgroups, be successful, however, the Virginia's Mathematics Standards of Learning (SOL) assessments show that students in grades sixth and seventh are struggling to meet the current Standards. In February the bar was raised even higher when the Virginia Board of Education (VBOE) adopted revised mathematics SOL. Students who successfully complete Math 7 will now be prepared for Algebra I in the eighth grade. The VBOE also just passed requirements judging school systems on the number of "on-time" graduates and requiring economic and financial literacy for all. The challenges at middle school are unique. In comparison to elementary schools, middle schools have students with a wider range of academic needs; learning gaps are deeper; the scheduling and organization constraints are more involved; student motivation and social pressures are greater issues; and principals are more likely to feel the need to delegate responsibilities specific to the mathematics program. Well-prepared Middle School Mathematics Specialists can help schools address these concerns.

Evaluation of the current Mathematics Specialist Program shows that elementary mathematics specialists are receiving a strong preparation and making a difference in student achievement. Now the goal is to ensure this same level of preparation for middle school specialist. The 2008 Middle School Mathematics Specialists Task Force was formed to consider how the current Mathematics Specialist Program could be modified to better address the needs of middle school mathematics specialists so they, in turn, could better help middle school teachers and students. After a review of the curriculum content of the current program and a study of research on 21<sup>st</sup> Century demands on middle school instruction, these recommendations are a summary of the key findings of the Task Force:

1. Middle School issues should be integrated into both the current content and leadership courses. Middle school mathematical concepts, content-focused pedagogy and school structures and social demands specific to middle school should be included. One method for addressing these areas is through the use of case studies involving middle school classroom scenarios. Middle School student work should also be analyzed, compared and evaluated.
2. The current content courses include work in: Number Sense, Rational Numbers, Geometry, Functions and Algebra, Probability and Statistics. An additional algebra course beyond the current Functions and Algebra course should be required for

middle school Specialist. (An additional course for elementary specialists should also be created with a focus on early number sense.) This change will bring the number of required content courses for all K-8 Specialists to six.

3. In planning the overall program, the concepts and instructional strategies of the six content courses should be reviewed holistically to ensure alignment and to maximize the specialists' opportunities to make connections and build understandings.
4. In planning each course, classroom instruction should be differentiated when appropriate to include both elementary and middle school content and the study of school organizational structures. Out of class assignments for middle school specialists should provide specific opportunities to focus in depth on middle school issues.
5. The focus of the three leadership courses should remain the same: Leadership I: Quality standards based instruction; Leadership II: Teacher leadership and coaching as a tool for improving teaching and learning; Leadership III: Continuous improvement of the school based mathematics program. Due to the wide range of needs found within middle school classrooms, course work for Middle School Specialists must explicitly address ways to provide every students' "opportunity to learn" and ways to ensure equity to all. Co-teaching especially between regular education and special education teachers is a focus that Middle School Specialists must be prepared to support. Interdisciplinary teaming and collaborative teaching are also strongly emphasized in most middle schools so specialists must be comfortable working across all curriculum areas to help teachers and students make connections.
6. Course experiences should prepare coaches for challenges specific to the middle school level; such as, dealing with learning gaps, addressing student motivation issues, and looking at equity issues. As leaders, specialists must also learn to tactfully handle situations involving teachers who have been identified as the "mathematics teachers" and consequently, may be reluctant to seek or accept help with mathematics content if their credibility is threatened by admitting they need or want help. Also, Middle School Mathematics Specialists must be prepared to accept certain administrative responsibilities which a principal may delegate because the school is so large and/or they may or may not have strong mathematical content knowledge themselves.

If the current Mathematics Specialist Program is tailored to meet the needs of the middle school mathematics specialists based on these six recommendations, then graduates of the program should have the understandings needed to provide the support to teachers that will allow them to prepare students for the demands of our future world.

## *Middle School Mathematics Specialists Task Force Report*

### *Introduction*

The integrated and balanced development of all five strands of mathematical proficiency (conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition) should guide the teaching and learning of school mathematics. Instruction should not be based on extreme positions that students learn, on the one hand, solely by internalizing what the teacher or book says or, on the other hand, solely by inventing mathematics on their own. (Kilpatrick, Swafford & Findell, 2001, p. 11)

The above statement is taken from *Adding It Up: Helping Children Learn Mathematics*, a report that synthesizes “reliable information on learning of mathematics by schoolchildren that could be used to guide best practice in the early years of schooling” (Kilpatrick, et al., 2001, p. 3). The report addresses a host of important issues related to teaching and learning pre-kindergarten through eighth grade mathematics. This work grew out of a charge by the National Research Council (NRC) at the request of the National Science Foundation and the U.S. Department of Education to develop a report that clarified the state of affairs of mathematics instruction in the United States. The Committee of Mathematics Learning, a committee appointed by the NRC, organized their findings into five strands to describe what constitutes successful learning of mathematics, or what they refer to more generally as *mathematical proficiency*.

Mathematical proficiency comprises conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition. The Committee argues that these five, interdependent strands are intricately related. Their report reflects research findings on best practices in mathematics teaching and learning. For instance, with regard to teaching conceptually, others have argued that this type of teaching should be teachers’ primary responsibility (e.g., Ball & Bass, 2000; Schifter, 2007). Further, if teachers are to implement standards effectively, they must have a deep understanding of the mathematics that they teach (Ball, Thames & Phelps, 2008; Ma, 1999; Ball, Lubienski & Mewborn, 2001; Shulman, 1986). So we as mathematics teachers (and mathematics teacher educators) can support the development of a school culture that embraces the idea of teaching for mathematical proficiency and provide support to individual teachers as they work to strengthen their own and their students’ mathematical knowledge. It is important that our teachers understand mathematics conceptually. It is important that our teachers understand how and why mathematical procedures work. It is important that teachers develop a mathematical disposition in which they see “mathematics as sensible, useful, and worthwhile” and that they can problem solve and see themselves as effective mathematical learners (Kilpatrick et al., p.115). If our teachers do not understand what teaching mathematical proficiency entails, it is not likely that their students will have opportunities to learn mathematics successfully. We will be less likely to provide opportunities for lower socioeconomic status (SES) and minority students to narrow the achievement gaps that continue to persist even after nearly two decades since the National Council of Teachers of

Mathematics (NCTM) offered standards for teaching and learning mathematics (Lubienski, 2007; NAEP, 2008).

In order to teach for mathematical proficiency teachers need to understand deeply the mathematics that they teach (Kilpatrick, Swafford & Findell, 2001). They also need to have an understanding of how to develop and implement lessons in which their students have opportunities to explore and make connections among concepts (Schifter, 2007). Because there are greater demands on teaching mathematics for understanding, there are also greater demands on developing and implementing effective professional development experiences that support this type of instructional practice (Schifter).

Often teachers have not had opportunities to learn mathematics conceptually; they face the challenge of understanding the mathematics they teach, often as they work with students (Ball, Thames & Phelps, 2008; Kilpatrick, Swafford, & Findell, 2001). These challenges become more pronounced as teachers work with middle school students. With the call to meet the needs of *all* students, middle school mathematics teachers must have a skill set to work with a wide range of students with different academic needs. In some cases, students have not yet adequately mastered content that was introduced in the elementary grade curriculum. In other cases, students need additional opportunities to explore more advanced mathematical topics. More generally, teachers must find ways to teach more advanced mathematical concepts effectively—concepts that they may not understand or that they may not know how to present to their students.

One of the more effective ways that we can promote this kind of mathematics instruction is through the use of well-prepared Mathematics Specialists. These Specialists will be called on to be mathematics teacher leaders. They must have a deep understanding of the content and content-based pedagogy when working with teachers in their school buildings (Ball, Thames & Phelps, 2008; Schifter, 2007). If teachers do not develop these deep understandings, it is less likely that their students will have opportunities to do so. Without a deep understanding of mathematics, students will have few opportunities to meet the demands of an ever-changing society that depends more and more on engaging in a range of learning and innovation skills such as critical thinking and problem solving (Partnership for 21<sup>st</sup> Century Skills, 2009). To address the advances and challenges of the 21<sup>st</sup> century, we are assured that students must be prepared to use their mathematical knowledge and apply this knowledge to solve a host of problems in the workplace and in their daily lives (cf., National Mathematics Advisory Panel, 2008). Thus a preparation program that promotes mathematical proficiency for teacher leaders is an important and necessary first step in promoting student learning.

One of the primary goals of this report is to recommend a preparation program for Middle School Mathematics Specialists—a program that provides potential teacher leaders numerous opportunities to acquire and be ready to apply knowledge of mathematical content and pedagogy as they work with middle school teachers. Because an effective professional development program must positively affect student achievement outcomes (Loucks-Horsley, et. al., 2003), a preparation program for Specialists is a necessary step in offering support and providing professional development for classroom teachers. Further, Specialists can help classroom teachers develop a deep understanding of and appreciation for mathematical content and pedagogy; they can positively impact student achievement. Additionally, middle school teachers face many challenges that are different from those faced by elementary teacher

leaders. These challenges are unique to the context and the students with whom they work. So a preparation program must take care to address these challenges as they prepare these Specialists that can in turn support the work of middle school teachers. The Commonwealth already has a teacher leadership program to effectively prepare elementary Mathematics Specialists, thus it is an opportune time to build on this program to develop a program that effectively prepares Middle School Mathematics Specialists.

In the following sections we provide a rationale for the preparation of Middle School Mathematics Specialists. We also report results of an informal survey that provides additional support for Middle School Mathematics Specialists. Following this discussion, we outline competencies and course requirements for the recommended program. Before we address these issues, we provide a history of the Mathematics Specialist initiative in the Commonwealth to provide a context for our discussion.

### *History of the K-8 Mathematics Specialist Program in Virginia*

There is a rich history of supporting programs for preparing Mathematics Specialists in Virginia (The Virginia Mathematics and Science Coalition, 2002). The Virginia Mathematics and Science Coalition (VMSC) Task Force Report (2002), indicates that the concept of a content Teacher Specialist evolved from a Lead Teacher model that was established more than ten years prior to the writing of their report. Through V-QUEST, a joint, collaborative effort between VMSC, Virginia Department of Education and Virginia Council of Teachers of Mathematics and funding from the National Science Foundation, university and district personnel across the state prepared elementary and middle school teachers of mathematics and science to become *Math Leaders* and *Science Leaders* in their schools. After completing this three-year program, these teacher leaders returned to their buildings and “lead efforts toward improving teaching and learning in mathematics and science” (p. 9). The impact of these Lead Teachers was still being felt at least three years after they completed this three-year program. In a follow-up survey in nine representative Virginia school divisions where these specialists were placed, the VMSC report stated that several divisions attributed the rise in test scores to the work of these Lead Teachers that participated in this three-year program.

VMSC Task Force (2002) also reported findings from a survey that was administered to leaders and supervisors from 43 Virginia school divisions. The findings from this survey corroborated Critchfield and Pitt’s (1997) findings: the concept of mathematics specialists “lives on in schools across the Commonwealth” (p. 9). However, this survey also revealed that there was no statewide agenda to continually prepare content-based Teacher Leaders or content specialists. In addition, the roles of these Math Leaders were not clearly defined—in many cases these leaders served as liaisons between the district office and the school buildings. Equally important, they reported that the surveys indicated that there was a “critical need for the Mathematics Teacher Leaders to take a more active role in providing staff development for teachers and leadership for the building level mathematics program” (p. 10).

Since the 2002 VMSC report, much progress has been made across the Commonwealth to support the preparation of K-8 mathematics teacher leaders. University faculty and school division personnel have worked hard to develop a statewide

program that prepares Mathematics Specialists. With the help of several National Science Foundation grants as well as support from the Virginia Department of Education, two cohorts of teachers have completed a K-8 Mathematics Specialist program. Currently, approximately 250 schools have full-time Mathematics Specialists across the Commonwealth. There are also approximately 200 additional teachers currently enrolled in the K-8 program across the state, 40 who will likely be placed in middle schools.

While much progress that has been made since the VMCS Task Report (2002), this work needs to continue. The Virginia Board of Education (VBOE), for its part, has recommended the placement of one Specialist for every 1,000 students. Even though this recommendation is currently unfunded, it holds great promise for continuing to prepare and place Mathematics Specialists. Further the Commonwealth has spearheaded two initiatives that will provide support for the placement of Specialists. The first of these initiatives, the Algebra Readiness Initiative (ARI), can be tapped to assist school divisions whose students need additional academic support to become successful in algebra. Because Middle School Mathematics Specialists, as part of their roles, would help teachers provide support for students who struggle with foundational concepts leading to algebra, ARI funds could be used to place Specialists to support teachers as they help their students. The second initiative, the Teacher Corp, might also be tapped to place Specialists in those challenged schools that successively have not met AYP accreditation. Specialists could work with teachers to better prepare them to meet instructional challenges and to support student learning. So there are several initiatives underway in the Commonwealth that might support the preparation and placement of Middle School Mathematics Specialists. This said, to date, many of the 130 school divisions in the Commonwealth have not had the opportunity to participate in these Specialist programs. In fact, some divisions do not even have personnel to serve in supervisory roles for mathematics teaching and learning. So although some school divisions understand the critical role that Mathematics Specialists might have in school buildings, there are many divisions who have yet to benefit from these preparation programs. Alternately, some divisions are ready to place Mathematics Specialists but are not able to do so because there is there is a shortage of teachers who have completed the program.

There is a growing need to expand the current preparation program which primarily offers support to K-5 Mathematic Specialists. This program must be enhanced to address the unique demands placed on Middle School Mathematics Specialists. With the current program for preparing Specialists in place, the time is ripe to purposefully tailor this program to include knowledge of more advanced mathematical topics and pedagogy to prepare Middle School Mathematics Specialists to meet the challenges that middle school mathematics teachers must address.

### *Rationale for the Middle School Mathematics Specialist*

#### *Rising expectations for students*

Student gains on national and international mathematics tests are mixed. U.S. 4th and 8th grade students continued to improve (slightly) on the 2007 Trends in International Mathematics and Science Study (TIMSS) (Mullis, et al.,2007). However, there was no significant difference between 8<sup>th</sup> graders' mathematics performance on

TIMSS between 2003 and 2007. The striking difference falls along the number of students reaching advanced, high, intermediate or low benchmarks. Over 40% of those Asian 8<sup>th</sup> graders in the top tier reached advanced benchmark (625 raw score) in comparison to 10% of U.S. 8<sup>th</sup> graders. At the next highest level, high benchmark (550 raw score), over 70% of the Asian 8<sup>th</sup> graders in the top tier met this benchmark in comparison to 40% of U.S. 8<sup>th</sup> graders. Whereas students' performance is by no means disparaging, there continue to be substantial gaps in how U.S. 8<sup>th</sup> grade students perform in comparison to students representing the five top scoring countries.

At the national level, 4<sup>th</sup> and 8<sup>th</sup> grade students continued to make slight gains on the National Assessment of Educational Progress (NAEP) (Lee, Gregg, & Dion, 2007), a mathematics test administered to a random sample of 4<sup>th</sup> and 8<sup>th</sup> graders in the United States. Virginia 8<sup>th</sup> grade students test scores continued to improve from 1990 to 2007. In 2007, 23% of 8<sup>th</sup> graders did not meet basic proficiency requirements whereas in 2005, 25% did not do so. Virginia 8<sup>th</sup> graders fared slightly better than the national average—30% of all 8<sup>th</sup> graders who took the test did not meet basic proficiency. Disaggregate data are less promising. Gaps continue to exist between White and other subgroups. For instance, in 2007, Black students average scores were 28 points less than that of White students. These differences have changed by 1 point since 1990.

In the Commonwealth, educators and policy makers continue to set high standards for the success of every student by adhering to The *No Child Left Behind Act of 2001* (NCLB). Virginia schools also strive to meet the high standards for learning and achievement required under Virginia's Standards of Learning (SOL) program. Schools and school divisions that meet the annual objectives required by the federal education law are considered to have made adequately yearly progress (AYP) toward the goal of 100 percent proficiency of all students in reading and mathematics by 2014. Additionally, with the new revisions to the SOL, K-8 schools will be encouraged and even required to emphasize the foundation of algebra. For instance, middle school students who successfully meet algebra standards should be prepared to study Algebra 1 in grade 8. So middle school teachers continue to face new challenges with developing and implementing instruction that includes addressing more advance mathematical concepts, particularly around topics that prepare students to be successful in algebra.

The state assessment system has been implemented to monitor student progress in meeting the Virginia Standards of Learning (SOL). School divisions continue to be held accountable to ensure that all students have opportunities to be successful. Students at 3<sup>rd</sup> through 8<sup>th</sup> grades are given assessments and middle and high school students are given end-of-course assessments to determine if they have adequately mastered the mathematical content. Although there has been some progress in the middle grades, there is still a need for more students to successfully pass the SOL tests. The 2007-08 Virginia SOL test results posted on the Virginia Department of Education (VDOE) website reveal that thirty-two percent of sixth graders and 35% of all seventh graders did not pass the grade-level tests in mathematics. Seventeen (17) percent of the eighth graders did not pass. Although the 8<sup>th</sup> grade test scores are encouraging, 6<sup>th</sup> and 7<sup>th</sup> grade scores are quite troubling.

Because the scores varied markedly among 5<sup>th</sup>- 8<sup>th</sup> grades, the Department of Education convened a committee of middle school administrators, teachers and specialists to consider possible reasons for the disparity among scores. Clearly because

the 6<sup>th</sup> and 7<sup>th</sup> grade SOL tests have only been administered for three years, some variation in students' scores should be expected. The committee also noticed that other factors may contribute to these differences. For instance, there are noticeable differences between test items that address the same content across the grades. They noted that sixth-grade assessment items seemed to require that students apply mathematical knowledge in problem solving situations. By way of contrast, items that addressed the same content on the 5<sup>th</sup> grade test were more computationally focused. Because of these and possibly other factors that may have had a negative impact on 6<sup>th</sup> and 7<sup>th</sup> grade SOL test scores, the committee recognized that the teachers at these grade levels need additional support as they work to positively influence student achievement.

The results from the 2007 spring administration of the sixth- and seventh-grade mathematics *Standards of Learning* tests showed improvement over the previous year. In an effort to identify the best practices that lead to some schools showing an over 20% improvement in pass rate, the VDOE conducted a survey of a sampling of those schools which showed increased performance the second year the tests were administered. As the report indicates there are several best practices identified in the survey as leading to higher student achievement. Most noticeable was the fact that 42% of the schools stated that they had placed a part-time or full-time Mathematics Specialist. The Specialists “modeled lessons, met with teachers during common planning to design lessons and refine pacing guides, and provided professional development, among other duties” (VDOE, p. 3). Ninety-one (91) percent of the schools responded that “they made a conscious effort to increase the amount of time teachers had to collaborate” (VDOE, p. 2). Among other findings, 87% of the schools reported that they had “created multiple remediation and intervention opportunities for their students” (VDOE, p. 2). These three factors, when coupled together, speak to the role that the Specialist might play in supporting student progress. If the goal of the Specialist is to provide support for teachers that in turn can positively affect student achievement gains, then it is imperative that the Specialists have quality opportunities to assess students, to develop a plan with teachers that support their students' needs and to facilitate an environment in which teachers can learn with and from one another.

Additionally, disaggregated data from 2007-08 revealed that there continues to be gaps in SOL test results among AYP subgroups. Note in the table below that White students significantly outperformed all other students. For instance at the 7<sup>th</sup> grade level, White students' scores on average were 22 points higher than that of Black peers. Similar differences are found when comparing White students' scores with Disabled students, Disadvantaged students and LEP students. (See Table I below for additional information.)

Table I. Percent of Students Passing 2008 SOL Mathematics Tests

	<b>6<sup>th</sup> grade</b>	<b>7<sup>th</sup> grade</b>	<b>8<sup>th</sup> grade</b>
<b>White students</b>	75%	74%	89%
<b>Black students</b>	53%	50%	72%
<b>Disadvantaged students</b>	53%	51%	72%
<b>Disabled students</b>	49%	50%	58%
<b>LEP students</b>	51%	49%	72%

## *Improving Instruction*

One of the ways to improve student learning is to implement instructional programs that are grounded in the teaching and learning of significant mathematics for understanding. These programs need to provide teachers opportunities to deepen their own understanding of knowledge of mathematics and pedagogy. As content becomes more complex in the middle grades, it is even more important for teachers to have numerous opportunities to explore deeply the mathematics that they teach.

There continues to be a national interest in supporting Mathematics Specialists in K-12 education. For instance, states across the United States, have received federal support to implement and determine the effectiveness of mathematics teacher leader programs (e.g., Nebraska's *Math in the Middle Institute Partnerships*, Virginia's *Preparing Virginia Mathematics Specialists*, and Oregon's *Oregon Mathematics Leadership Institute*). These and other programs were developed in part because there remains a need to provide extensive, on-the-job professional development for teachers of mathematics. K-8 teachers continue to report that they are not comfortable with and often do not understand the mathematics topics that they teach. To address these concerns, several recent documents (e.g., National Research Council's, 2001, *Adding it Up: Helping Children Learn Mathematics*; National Council of Teachers of Mathematics, 2000, *Principles and Standards of School Mathematics*; National Math Panel Report, 2008; National Council of Supervisors of Mathematics, 2008, *The PRIME Leadership Framework*) call for qualified Mathematics Specialists to be placed in schools as a resource for improving instruction (cf., VSMC, 2002). The National Council of Supervisors of Mathematics report is particularly timely in that it provides a framework for the content that mathematics teacher leaders might need to successfully support teachers' daily work.

In the next section we highlight challenges that are unique to those teachers who teach mathematics to 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> grade students.

### *Middle School Mathematics Specialists*

#### *Role of School-based Specialists*

What additional challenges do middle school teachers face in their daily work? The Middle School Task Force has identified a list of some of the challenges that middle school teacher leaders face that are different from what the elementary teacher leader faces. Some of these differences and accompanying challenges are addressed below:

1. *The Middle School Mathematics Specialist must accommodate students with a wide range of academic needs.* She must understand that some students have performed well below grade expectations for several years. As these students begin to learn mathematics that is specific to the middle school curriculum, they will face greater and greater challenges. The Specialist must have an understanding of elementary and middle school mathematics concepts and be able to develop ways to help teachers devise and implement remediation plans that take into consideration fundamental ideas in the elementary curriculum.

To meet this challenge, the Specialist will need to understand how she might adjust elementary school curriculum to meet the needs of the middle school student. Additionally, she must find ways to support teachers as they implement instruction that integrates the elementary concepts with those found in the middle school mathematics curriculum. She must also support those more advanced students who need additional and different opportunities to explore mathematical ideas more deeply. To support these more advanced students, she also will need to have knowledge of content found in the high school curriculum and an understanding of how to help teachers implement instruction that addresses this content.

2. *The Middle School Mathematics Specialist must develop a range of skills to handle scheduling and organizational constraints.* Often, at the middle school level, content-specific instruction is departmentalized. However, middle school teachers often work on interdisciplinary teams with planning time organized around these groups. Content focused meetings must take place before or after school hours. Teachers may also have other teaching assignments besides teaching mathematics. So they may be members of several instructional teams within the school (e.g., biology, special education, etc.). The Specialist must find ways to manage these scheduling challenges so that she can effectively work with all teachers of mathematics. In addition to the scheduling demands with teachers, the Specialist should work with the classroom teacher and guidance counselor to ensure that students are placed in the appropriate mathematics class. Student schedules become more intricate as they begin to switch teachers for every class and the array of course options grows. The Specialist must be able to interpret test scores and other relevant data to help teachers make decisions about which course will meet a student's academic needs. They should also help make decisions about where to place new students who enter the school at other times during the school year.
3. *The Middle School Mathematics Specialist must find ways to support teachers as they motivate their students to learn mathematics.* Middle school students may lack the confidence and/or interest to become successful in mathematics. Not only academic concerns but peer pressures and social concerns gain importance as students enter adolescence. If they are not successful in learning mathematics, this may have grave consequences for their continued success in middle school, high school and beyond. The Mathematics Specialist has the monumental task of supporting teachers as they help motivate all students to learn mathematics successfully.
4. *The Middle School Mathematics Specialist must help teachers develop and implement effective 1½-hour mathematics lessons.* Many middle schools have incorporated a block schedule for instruction. This means that teachers must design lessons that appropriately engage their students for longer periods of time. Teachers may only see their students every other day. The mathematics teacher leader can support teachers as they develop new or revise old instructional strategies to fit with these scheduling demands.
5. *Middle School Mathematics Specialists have more autonomy.* Many more

students attend a given middle school—typically one middle school will serve as a feeder school for students from several elementary schools. With the demand of supporting large student enrollments, the Principal must delegate selected responsibilities to others. The Principal may not be able to be directly involved with supporting all teachers’ content specific needs particularly if she does not have a background in teaching mathematics—the content is much more complex. Thus, the Mathematics Specialist needs to take on a leadership role and work collaboratively with the Principal to provide support for teachers’ mathematics instructional needs.

These challenges are among those that middle school teachers may encounter in their daily work. To meet these challenges, the middle school teacher leader must have a deep understanding of the mathematics that is taught in elementary and in more advance courses taught in high school, such as algebra and geometry. She must also have an understanding of and how to implement appropriate instructional strategies that might support student learning. She must also have an understanding of how to develop and implement assessment practices with her teachers, including formative and summative, and be able help her teachers to use assessment results to inform them about their students’ understanding and to use this information to inform their instructional decisions. Next, we outline information we gathered from an informal questionnaire pertaining to the challenges of School-Based Specialists.

#### *Survey on the Challenges of School-Based Specialists*

To better understand the middle school teacher leader’s role, a subcommittee of the Middle School Task Force administered an informal questionnaire to 4 individuals who serve in key roles in three different school divisions. Each participant has had experience serving or working with mathematics specialists at either the middle or elementary schools. One participant, *Assistant Principal 1*, has served as an assistant principal at middle school for 2 years. Prior to being a middle school assistant principal, she served as an elementary school teacher and middle school grade level administrator. Another participant, *Math Coach*, has served as a math specialist for 1½ years and has been a lead teacher in her school building for a number of years. Prior to serving in this leadership role, she was a middle school teacher who was certified to teach middle school and elementary school. The third participant, *Teacher*, is a regular, first year middle school teacher who has worked extensively with a middle school mathematics specialist. Before being at her current position, she was a lower grade elementary school teacher. The fourth participant, *Assistant Principal 2*, has worked with math coaches as an assistant principal at both the elementary and the middle school levels.

Below we summarize their responses to several questions that they responded to during on-line or phone interviews. Their responses are framed around the 5 challenges that are unique to Middle School Mathematics Specialists. Each challenge is in bold. The participants’ responses are italicized. (We address only 3 of the challenges for the sake of brevity.)

**The Middle School Mathematics Specialist must accommodate students with a wide range of academic needs.**

Participants made several general comments about how important it was for teachers to understand the content that they teach as well as how to deliver that content to students with different academic backgrounds. *Assistant Principal 1* addressed both of these issues in her comment:

*Middle school math teachers need support in finding new and engaging ways to deliver instruction that require students to analyze and problem solve on their own rather than simply mimicking the teacher's examples. Some middle school teachers also need professional development in math content to deepen their own content knowledge...*

She also stated that they needed opportunities to develop understandings about *the logic behind incorrect work and misconceptions their students have*.

*Assistant Principal 2* stated that she expects her teachers to have a *high level of understanding of math concepts*. She went on to say that middle school teachers sometimes have difficulty using their mathematical understandings to differentiate instruction; they tend to teach in ways that they are comfortable with—using procedures:

*Often teachers at this level lack knowledge of how to differentiate instruction for diverse learners and are more comfortable using procedural approaches when explaining the mathematics.*

Both Assistant Principals mentioned that middle school teachers have difficulty meeting the challenge of working with students that do not understand the key concepts that they are to learn.

*Math Coach* also addressed this issue. She gave at least one reason why middle school teachers have difficulty differentiating instruction.

*I have a handful of teachers at each school that do not have elementary school training at all. A lot of our students that these teachers are working with are not on grade level ... These teachers continually say to me, "the students do not even know their multiplication facts."*

As the above comment suggests, for *Math Coach*, middle school teachers need to understand the concepts that are taught in the elementary school. In fact, later during the interview she stated that teachers that had some form of elementary training or understanding of the content that is addressed in the elementary curriculum were better prepared to meet the academic needs of their students. She then gave an example to illustrate her point. Some of her teachers were aware that their students had trouble recalling multiplication facts. She recalled that when she asked teachers what ideas related to multiplication that their students did know (e.g.,  $2 \times 3$  means 2 groups each with 3 things), teachers stated, "*I was not trained that way.*" As her teachers' comments suggest, they did not have the skills that they needed to address their students' needs. They assumed that their students had learned content that was addressed in the earlier grades. If they taught 6<sup>th</sup> grade, they assumed that their students would be ready to learn 6<sup>th</sup> grade mathematics. To further illustrate her point, *Math Coach* gave another example

recounting a conversation that she recently had had with her middle school teachers during one of their math meetings:

*We actually want to [help students in the AYP subgroups pass the SOL test], but they don't have the foundational skills. Do we jump back to the third grade skills that they do not have as a 7<sup>th</sup> grader and teach and try to get up to 7<sup>th</sup> grade? Or do we teach 6<sup>th</sup> and 7<sup>th</sup> grade skills in isolation to just those kids because they need it for the [SOL] test?*

As this comment suggests, middle school teachers were not sure how to meet these unanticipated challenges. As the Specialist, part of her role was to help teachers meet these types of challenges. She was also aware that although they addressed these issues during their math meetings, answers to these types of questions are not easily answered. Teacher's comment below also mirrors those made by the other participants.

*The biggest challenge for me has been to make sure I'm extremely knowledgeable about my subject area. It was much simpler in elementary to attach a concept (such as multiplication) to a picture or a physical representation. I have found it more challenging in middle school to give my students tangible examples to understand the tougher mathematics concepts.*

To summarize the participants' comments, the Specialist needs to help teachers in the middle school meet the needs of students who may be below grade level. To do so, the Specialist must understand concepts addressed in the elementary and middle school curricula and she must know how to effectively deliver instruction around those concepts for middle school students. She must also have the leadership skills to help teachers develop effective instructional strategies to teach these concepts. Additionally, the Specialist must have the knowledge and skills to help those students who may be ready to explore more advanced ideas found in the high school curriculum.

### **The Middle School Mathematics Specialist must develop a range of skills to handle scheduling and organizational constraints.**

For Math Coach, having time to work with all her teachers continues to be her biggest challenge. She is currently working with teachers in two middle schools. She is responsible for 8 full time teachers, one part-time teacher and 4 Special Education Teachers in one middle school and 12 teachers and 4 Special Education Teachers in the other middle school. She travels between schools to work with as many teachers as possible each week. Scheduling meetings with teachers was one of the biggest challenges that she faced immediately from the outset of the school year. To remedy the situation, after confiding in her Math Supervisor, she decided that she needed to structure her time so that if she needed to reschedule a meeting every other week she should do so. She also encouraged teachers to contact her if they needed her to meet with them more often than she had regularly scheduled.

Finding time to work with teachers was also challenging because some middle school teachers teach multiple grade levels and/or they teach more than one subject. So it

was difficult to schedule regular grade level meetings with them. Math Coach put it succinctly in her comment below:

*I have twice the number of meetings and half the amount of time in each building because [I am assigned to] two schools.*

To address the scheduling challenge, Math Coach works with fewer teachers on alternate weeks. She also schedules a monthly meeting with all the teachers.

*I meet with maybe 2 of the 7<sup>th</sup> grade math teachers at one time and two of them at another time to just focus on grade level material and then once a month we meet all the math teachers in the building...*

Although she manages her schedule as best she can, some teachers are unable to meet with her simply because they are *meeting-rich*. The special education teachers were less likely to make the meetings with all the math teachers for this reason.

*Teacher* also talked about how often she met with her Specialist. As a new middle school teacher, she found these meetings *extremely beneficial*. As the next comment suggests, she actually meets with her Specialist (Coach), frequently. In fact, the principal has made common planning for mathematics teachers a priority in this school.

*I meet with our math coach every other day during my personal planning, during department meetings, and typically at least two other times during the week.*

So although there are challenges with scheduling, Specialists develop methods for meeting those challenges. When they cannot meet with teachers, they may ask other teachers who *got it* and who *know what is happening* to meet with and help other teachers. *Math Coach* used this strategy sometimes.

### **Middle School Mathematics Specialists have more autonomy.**

Because a large number of students are enrolled in a middle school, Middle School Mathematics Specialists often have more responsibilities than K-5 Specialists. The principal may need to delegate selected responsibilities to the Specialist with regard to mathematics instruction in the school building. Because of the different participants' roles in the school, they addressed this issue from different vantage points. Both Assistant Principals for instance, explained what they perceived to be the Specialist's role. They also mentioned that they met with the Specialist and communicated what they believed to be her responsibilities. For instance, *Assistant Principal 1* explained that she met with the Mathematics Specialist at the beginning of the year to establish goals for the school year:

*I sat down with the coach at the beginning of the year and discussed goals for the year, which included having her co-teach for the duration of a unit with each of our newer teachers. I asked the coach to meet with the grade levels during their collaborative planning a couple of times each month in order to support their instructional planning and find times to work with them in their classrooms.*

As her comment suggests, she communicated that the Specialist needed to work with new teachers as well as with the other teachers throughout the school year. She also expected the Specialist to engage in collaborative planning with teachers each month. In addition she expected her to work with individual teachers as they implemented lessons. *Assistant Principal 2* made similar comments. She indicated that she *collaborated with the Math Specialist on a regular basis about teachers' work*. She also had follow-up conversations with the classroom teachers to make sure that the Specialist supported the teachers' work. And she asked the Specialist to schedule times for teachers to observe one another's teaching and to have debriefing sessions following these observations. So both administrators explicitly stated that they worked with the Specialist and communicated that they expected the Specialist to work closely with teachers. *Assistant Principal 2* also communicated that she also ascertained if the Specialist provided the necessary support that teachers needed.

*Math Coach* provided additional insight into the principals' expectations regarding the scope of her role. One of her building principals had a more *hands-on approach* than the other. Not surprisingly, the principal who delegated more responsibility was responsible for a much larger student population that was transient, which needed a range of special services, and so on. Because these and other duties took a great deal of her time, *Math Coach* was largely responsible for supporting math instruction in her school building. *Math Coach's* comment below summarizes the degree with which she had autonomy in each school building:

*One of my principals takes a real hands-on approach and wants to know a lot about our kids' test scores and a lot about our placement of students. In the other school, the principal really trusts me to be on top of that. I report to her when there are issues or questions to keep her informed...but she doesn't necessarily take time to sit and go through all of that information herself.*

*Math Coach's* comment points to the range of responsibilities that she has across schools. In one school she needed to play a much more autonomous role than in the other school. Later she also indicated that although she served in different capacities in each school, both principals were *very supportive* and *trust me to call math meetings and try to stop in* when possible. We suspect that like *Math Coach*, Specialists that serve larger populations may need to take on more responsibilities for math instruction in the school building. These responsibilities will likely include scheduling math meetings, grade-level meetings and working with individual teachers within the time constraints that are specific to middle school programs, ,

In this section we have outlined aspects of the Specialist's role that are unique to those who work in middle schools. Our discussion by no means has addressed all the challenges that these Specialists might encounter. By addressing some of these here we have a better understanding of the potential impact that she might have as she supports mathematical learning in the middle school. The unique challenges that she has serves as a backdrop for the next two sections of the report as we make recommendations for the Middle School Specialist's role and a preparation program designed to meet those specific challenges.

### *Recommended School-based Mathematics Specialist Responsibilities*

Mathematics Specialists are teacher leaders with strong preparation and background in mathematics content, instructional strategies, and school leadership. Based in elementary and middle schools, Mathematics Specialists are experienced teachers who are released from full-time classroom responsibilities so that they can support the professional growth of their colleagues, promoting enhanced mathematics instruction and student learning throughout their schools. They are responsible for strengthening classroom teachers' understanding of mathematics content, and helping teachers develop more effective mathematics teaching practice that allow all students to reach high standards, as well as sharing research addressing how students learn mathematics.

The overarching purpose of the mathematics specialists is to increase the mathematics achievement of all students in their schools. To do so, they:

- Collaborate with individual teachers, teams of grade level mathematics teachers, and with vertical teams across grade levels through co-planning, co-teaching, and coaching;
- Assist administrative and instructional staff in interpreting data (both formative and summative) and designing approaches to improve student achievement and instruction;
- Collaborate with teachers and teams of teachers to ensure that the school's instructional practices are aligned with state and national standards, as well as their school division's mathematics curriculum;
- Assist teachers' with delivery and understanding of the school curriculum through collaborative long-range and short-range planning;
- Facilitate teachers' use of successful, research-based instructional strategies, including differentiated instruction for diverse learners, and appropriate use of technology;
- Provide job-embedded professional development focused on both mathematical content knowledge and mathematical pedagogy;
- Assist teachers in fostering partnerships with parents/guardians and community leaders to foster continuing home/school/community relationships focused on students' learning of mathematics; and,
- Collaborate with administrators (both in and outside of the mathematics community) to develop a vision and to provide leadership through professional development and for a school-wide mathematics program.

### *Preparation for the Middle School Mathematics Specialist*

#### *Context for Learning*

Teachers in a Mathematics Specialist program need opportunities to learn from and with each other in a learning environment that fosters collaboration and inquiry. They can greatly benefit from working collaboratively with their peers in an environment

that is supportive and that continually provides opportunities for them to learn significant mathematics, develop a deeper understanding about how students understand and learn mathematics, and what instructional practices might best support student learning (National Mathematics Advisory Panel, 2008; Kilpatrick, Swafford & Findell, 2001). It would also be very important for these programs to be a coordinated effort among faculty from university arts and science departments and education departments as well as from school divisions. Each of these groups can offer a range of expertise as they plan and implement a program that prepares Middle School Mathematics Specialists.

The Middle School Mathematics Specialist Task Force, like the first VMSC Mathematics Specialist Task Force, believes that it is important that Specialists develop a deep understanding about the “big ideas” in the mathematics curriculum and the implications for student learning and teaching. We also believe that it is important for Specialists to learn mathematics in a setting where good instructional practices are modeled. They need an opportunity to strengthen their own mathematical proficiency and increase their knowledgeable of content pedagogical issues. Because school-based Specialists will provide leadership in a variety of ways, they must also have the opportunity to build on their own leadership skills and to develop skills that effectively support adult learners. They must learn to analyze and draw on current research in mathematics education, and apply this knowledge as effective agents of change. In sum, we recommend the following set of competencies that Middle School Mathematics Specialists need to demonstrate.

#### *Recommended Competencies for Mathematics Specialists*

- Support a commitment to every student understanding and successfully applying mathematics.
- Possess a deep understanding of the mathematics that teachers teach including a core knowledge base of concepts and procedures within the discipline of mathematics that incorporates the following strands: number systems and operations; geometry and measurement; statistics and probability; and, functions and algebra.
- Focus on a thorough development of basic mathematical ideas and skills, with an emphasis on understanding the sequential nature of mathematics, connections among mathematical ideas and the mathematical structures inherent in the content strands.
- Display careful reasoning and an understanding of the connections among mathematics concepts and procedures in solving problems.
- Possess an understanding of and the ability to use the five processes: becoming a mathematical problem solver; reasoning mathematically; communicating mathematically; making mathematical connections; and, using mathematical representations.
- Possess the ability to use and interpret meaningful measures of students’ skills and understandings in mathematics.
- Evaluate students’ work and students’ thinking and use this to inform instruction.
- Support the use of technology to improve teaching and learning mathematics.
- Demonstrate the ability to collaborate with teachers through co-teaching, mentoring, and coaching.

- Demonstrate the ability to identify teachers' individual professional development needs, and individualize staff development efforts to include both formal and job-embedded professional learning experiences.
- Demonstrate the leadership skills necessary to facilitate staff development in mathematics content, mathematics pedagogy, and assessment of student learning.
- Collaborate with local and district administration to set and meet the goals for teaching and their students.
- Know how to support teachers as they use knowledge of teaching and knowledge of content to facilitate student learning.

### *Recommendations for Middle School Preparation Programs*

Research and reports related to teacher preparation and professional development are vast. Common to many of these documents is that teachers need to deeply understand the mathematics they teach, how students learn mathematical ideas, and how to implement instruction that supports' student learning (e.g., Kilpatrick, Swafford & Findell, 2001). They also need to learn how to use these understandings about mathematics, students and instructional practices as they develop knowledge and skills in leadership. These documents also suggest that more traditional mathematics programs for teachers are not sufficient for helping them make connections between these domains of professional knowledge (Kilpatrick et al., 2001; Ball, Lubienski & Mewborn, 2001). As we have argued throughout this report, one promising approach for preparing mathematics specialists has been carefully tailored university graduate programs in which cohorts of teachers have opportunities to develop and apply this knowledge and skill as they prepare to be mathematics specialists. They have opportunities to learn from and with one another in an environment that fosters collaboration and cooperation, what is often referred to as a professional learning community (DuFour, 2004).

Teachers preparing to be middle school mathematics specialists need opportunities to deeply understand the mathematics that underpins the middle school curriculum. They must also have a deep understanding of the mathematics that students have already learned as well as be able to make connections among those ideas and with those mathematical ideas that students will learn as they study more advanced mathematics in high school. More specifically, content that is addressed in these courses needs to include number and operations, functions and algebra, geometry and measurement, as well as data analysis, statistics and probability. Additionally these courses need to address the five process standards: becoming a mathematical problem solver, reasoning mathematically, communicating mathematically, making mathematical connections, and using mathematical representations (NCTM, 2000). The content that they address as well as the classroom experiences that they have need to be relevant to the Mathematics Specialists' daily work. Instructors of these courses need to model effective content pedagogy and to provide many opportunities for Specialists to demonstrate their ability to implement effective teaching practices in their school. By doing so, Specialists can make connections between their own learning and how they might apply these ideas and practices in their school settings.

To build leadership skills, courses must be offered that will enable candidates to build a deep understanding of how students learn mathematics and of pedagogical knowledge specific to mathematics teaching and learning. Candidates will learn to

develop curriculum that is based on current research, including national and state standards for mathematics, and will design instruction that meets the needs of diverse learners.

Coursework will enable candidates for the Mathematics Specialist endorsement to develop skills in analyzing individual student performance on a variety of assessment protocols, and in analyzing and interpreting individual as well as collective test data. They will use the results from these analyses to inform instructional decisions. In addition, candidates will learn to gather and interpret relevant data about instructional strategies and instructional programs to facilitate improvements in student learning.

Programs preparing Mathematics Specialists will include the opportunity for candidates to develop skills in planning, implementing, and evaluating job-embedded support, and in staff development for all teachers including the mentoring of new teachers. Candidates for the Mathematics Specialists licensure must process the skills and knowledge necessary to effectively analyze and interpret research. Mathematics Specialists must develop effective communication skills to share research-based knowledge and skills with administrators, parents, and the greater community.

This Task Force identified five course content subcommittees to review and to make recommendations about modifications and additions to the current program that will lead to better preparation of mathematics specialists for middle schools. The five subcommittees are Number Sense and Rational Number, Algebra, Geometry, Probability and Statistics, and Leadership. A sixth subcommittee focused on the specific characteristics of middle school students and the unique structure of middle schools. Their work was incorporated into the main report and influenced the work of the other 5 subcommittees. Although some of the recommended course work is similar to that in the elementary program and perhaps the names of the courses will remain the same, we suggest that important additional content needs to be included in a program that prepares middle school mathematics specialists because of the unique challenges that these teacher leaders will likely face as they work with teachers and their students.

Here we identify key recommendations from the subcommittees on how the current program should be adjusted to help meet the needs of Middle School Mathematics Specialists:

1. Middle School issues should be integrated into both the current content and leadership courses. Middle school mathematical concepts, content-focused pedagogy and school structures and social demands specific to middle school should be included. One method for addressing these areas is through the use of case studies involving middle school classroom scenarios. Middle School student work should also be analyzed, compared and evaluated.
2. The five current content courses include work in: Number Sense, Rational Numbers, Geometry, Functions and Algebra, Probability and Statistics. The five subcommittees acknowledged that the current program provides strong preparation for the K-5 specialists and that Middle School Specialists should have the opportunity to study these same skills and concepts. However, the committees indicated in all cases that the content needed to be differentiated, when appropriate, to meet the needs of the middle school specialists.

- a. An additional algebra course beyond the current Functions and Algebra Course should be required for Middle School Specialists. For example, the specialists working in middle schools need to gain an extended and stronger understanding of algebraic concepts in Algebra I and Algebra II. (An additional course for elementary specialists should also be created with a focus on early number sense.) This change will bring the number of required content courses for all K-8 Specialists to six.
  - b. In addition there is a need to make connections between the content of the algebra courses and the Number Sense and Rational Numbers courses. More is needed to address a deeper understanding of fractions and the connections to algebra with an emphasis on generalizing. Middle school specialists must know how to promote an understanding of fractions, decimals, percents, and proportions by having students generalize from their conceptions of meaningful problem-solving situations.
  - c. A Middle School Specialist should have a comprehensive understanding of the geometry and measurement concepts and skills addressed in the K-8 mathematics curriculum, and should be familiar with the additional concepts included in a high school geometry course. In addition, mathematics specialists in middle schools should be prepared to use dynamic geometry software.
  - d. In Probability and Statistics more attention should be given to analysis and interpretation rather than definitions and procedures. Middle School Specialists should understand statistics and probability beyond the scope of specific middle school content in order to grasp the relevance and global importance of what they are teaching.
3. In planning the overall program, the concepts and instructional strategies of the six content courses should be reviewed holistically to ensure alignment and to maximize the specialists' opportunities to make connections and build understandings. Furthermore, more attention should be given to making connections between the K – 8 SOL content strands and the corresponding high school curriculum.
  4. In planning each course, classroom instruction should be differentiated when appropriate to include both elementary and middle school content and the study of school organizational structures. Out of class assignments for middle school specialists should provide specific opportunities to focus in depth on middle school issues.
  5. The focus of the three leadership courses should remain the same: Leadership I: Quality standards based instruction; Leadership II: Teacher leadership and coaching as a tool for improving teaching and learning; Leadership III: Continuous improvement of the school based mathematics program.
    - a. Due to the wide range of needs found within middle school classrooms, course work for Middle School Specialists must explicitly address ways to provide every students' "opportunity to learn" and ways to ensure equity for all.

- b. Co-teaching especially between regular education and special education teachers is a focus that Middle School Specialists must be prepared to support.
  - c. Interdisciplinary teaming and collaborative teaching are also strongly emphasized in most middle schools so specialists must be comfortable working across all curriculum areas to help teachers and students make connections.
6. Course experiences should prepare coaches for challenges specific to the middle school level; such as, dealing with learning gaps, addressing student motivation issues, and looking at equity issues. As leaders, specialists must also learn to tactfully handle situations involving teachers who have been identified as the “mathematics teachers” and consequently, may be reluctant to seek or accept help with mathematics content if their credibility is threatened by admitting they need or want help. Also, Middle School Mathematics Specialists must be prepared to accept certain administrative responsibilities which a principal may delegate because the school is so large and/or they may or may not have strong mathematical content knowledge themselves.

As addenda to this report, we have included individual subcommittee reports with specific recommendations on adjusting the current Mathematics Specialists courses to better address the needs of those specialists intending to work in a middle school setting.

#### *Middle School Mathematics Specialist Licensure*

Because a licensure process is already in place for K-8 Mathematics Specialists, we recommend that the requirements for licensure also be awarded to those teachers who successfully complete the proposed Middle School Specialist program. In the future the committee would support the Virginia Department of Education’s consideration of a specific Middle School Mathematics Specialist endorsement. The description of this endorsement should clarify the need for Middle School Mathematics Specialists to have at least an Algebra I Add-On endorsement. This requirement would help ensure that these Specialists had the content appropriate knowledge to accompany the pedagogical and leadership knowledge to needed serve teachers and students at the middle school level. School systems currently hiring Middle School Mathematics Specialists should seriously consider requiring them to hold a full mathematics endorsement or an Algebra I Add-On endorsement in addition to a Mathematics Specialist endorsement.

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