2015-2016 Advisory Council on Instruction
MATHEMATICS ADVISORY COMMITTEE
MEMORANDUM

TO: The School Board of Arlington Public Schools

FROM: ACI Mathematics Advisory Committee **DATE:** 11/4/2015

SUBJECT: Annual Report, 2015-16

COMMITTEE MEMBERS: Amy Beaumont, Stan Degler, Ron Fecso, Mark Hill (co-chair), Selene Ko, Mark Nadel, Ali Protik (co-chair), Judy Rudman, Dan Rosenbaum, Mona Siddiqui, John Sullivan

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1. INTRODUCTION

This report presents the Mathematics Advisory Committee's (MAC's) recommendations for continually improving the teaching and learning of Math in Arlington Public Schools (APS). These recommendations are intended to address the School Board's goal of eliminating the achievement gap within APS and reflects the MAC's advocacy of the importance of challenging and engaging all students in learning meaningful and applications-oriented Mathematics. The MAC has three (3) specific recommendations for the Advisory Council of Instruction (ACI) and the School Board to consider this school year:

1) Provide support, mentoring, and resources to teachers interested in using the "Flipped Classroom" approach;
2) Ensure employment of a full-time Math Coach at every elementary school; and
3) Increase transparency of math teaching methods in communications with parents.

Before setting forth our recommendations, the MAC wishes to re-emphasize its deeply held belief in the importance of basic mathematical knowledge for everyone. A basic fluency in mathematics and data analysis is an important skill not only in a large range of jobs but also in everyday life. Apart from any current educational trends or fads, in an increasingly technical world, it has become crucial for citizens to attain such fluency to understand investment information, polling/survey data, performance metrics and other forms of quantitative argumentation. The MAC also acknowledges the challenges APS faces regarding budgetary constraints and understands the advantages of working collaboratively with other ACI advisory committees. We, therefore, welcome any opportunities for fruitful discussions in regard to refining or modifying our recommendations.

2. 2015-16 RECOMMENDATIONS

This section presents the MAC's recommendations, and accompanying rationale for each, for this reporting cycle.

2.1. Recommendation #1: Provide support, mentoring, and resources to teachers interested in using the "Flipped Classroom" approach.

Background

A new approach to the use of classroom time, the "flipped classroom," has been gaining nationwide attention.[1] The concept is to dedicate classroom instructional time for engaging explorations and discussions about math. In the flipped classroom, teachers engage students in problem solving and guide them in the application of concepts during their face-to-face time together. This time to work is made possible because teachers will have made pre-recorded presentations of direct instruction available for students to watch outside the classroom—either at home, in libraries, or other places—before the class session. Various APS teachers from different elementary and secondary sites have already incorporated elements of the flipped classroom approach into their teaching method. Note that none of these APS teachers has adopted a "pure" flipped classroom teaching method. But for purposes of this report, we are treating even hybrid or "blended" methods as part of the flipped classroom approach.

In our 2013-14 report, the MAC recommended gathering information on, and studying the feasibility of, the "flipped classroom" approach at the secondary-level and assess its impact on student learning. Although the recommendation resonated with both APS staff members and the Board, a county-wide initiative to support this practice has not been put in place. However, since the 2013-14 school year, a small but increasing number of APS teachers have taken the initiative to explore a blended approach to teaching, at least for part of the instruction time, at different levels. We expect that this trend will only increase each year as teachers new to the profession complete preparation programs that include study of this pedagogical practice, or as veteran teachers have had time to experiment with the approach, at least in part.

According to an APS staff update last spring, APS has gathered some preliminary data[2] on the creation, implementation, and assessment of flipped classroom lessons and is currently gathering

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[1] *See* "When Schools Do Flips," N.Y. Times, Oct. 13, 2013, Sun, Review at 12 9 (http://opinionator.blogs.nytimes.com/2013/10/09/turning-education-upside-down/); See also http://opinionator.blogs.nytimes.com/2013/10/23/in-flipped-classrooms-a-method-for-mastery; http://www.washingtonpost.com/blogs/answer-sheet/post/flipping-classrooms-does-it-make-sense/2012/06/06/gJQAk50vJV_blog.html. The Flipped Learning Network, an online professional community for educators using this approach, was established in 2012 and the Annual Flipped Conference enters its 8th year in 2015.

[2] The information gathered to date is qualitative, i.e., which teachers are trying the flipped classroom approach, which grade levels/courses are exploring it, content of videos created, etc.

anecdotal data and providing professional development to teachers around technological and pedagogical practices. The MAC applauds the efforts of APS in gathering information and strongly believes that the effort to support the flipped classroom initiative should continue as it is very important to give teachers the autonomy to decide how to effectively deliver the material that they are required to teach and support them as needed.

In addition, we believe that the flipped classroom approach represents an innovative opportunity to shrink the achievement gap between disadvantaged and non-disadvantaged students within APS as this approach may mitigate the impact of the lack of academic support disadvantaged students may receive with their "homework." If executed successfully, the flipped classroom approach would enable teachers to spend more time working with students individually or in small groups during class and thus provide more support and enrichment as needed. The ability to provide greater differentiation in the classroom would also support the APS Strategic Plan goal of challenging and engaging all students. Furthermore, recorded lessons would permit students, as well as parents, to replay concepts they have difficulty understanding, possibly supporting the MAC's Recommendation #3 below (Increase Transparency of Math Teaching Methods in Communications with Parents).

Recommendation and Rationale

Given the above background, the MAC would like to recommend that APS offer its teachers, who wish to use the flipped classroom approach for part, or all, of their instruction, support, mentoring, and resources. Such support should encourage teachers with some interest in experimenting with this approach to learn more about how to implement it most effectively.

Subject to further discussion the MAC recommends the following actions:

Gathering resources in relation to the nature and use of the flipped classroom approach. Now that variations of the approach have been in use for several years and are being studied by an increasing numbers of education researchers, we expect that experts will soon be identifying the best practices and what may not be as effective. Given the plethora of research studies conducted in the last few years on flipped classroom approaches, APS staff should gather information from the literature and amalgamate the resources most relevant for APS teachers. The article "Flipping the Classroom" by Cynthia Brame of the Center for Teaching at the Vanderbilt University could be an excellent starting point.[3]

Professional development for teachers. Upon gathering information on different flipped classroom approaches and best practices, APS should offer to fund professional development for teachers interested in learning more about this approach to instruction. Professional development could involve sessions on flipping their classrooms by external speakers and/or by APS teachers who have

[3] https://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

experience with the approach. These sessions will also provide teachers an opportunity to exchange ideas and resources.

Online forum for APS staff, principals, and teachers. In addition to providing teachers with professional development, we also recommend the creation and publicizing of an online forum which would serve as an ongoing platform for APS teachers to share ideas, teaching materials, and experiences with flipped classrooms — the good and the bad — with the larger education community within APS if not with other teachers in Northern Virginia, all of Virginia, or nationwide. Such a forum will also connect teachers who share the same ideas and passion, and will allow for indirect mentoring.

Budget Impact

The cost for supporting, mentoring, and providing resources to teachers interested in the "flipped classroom" involve efforts largely from the APS staff in gathering information based on research, holding professional development for teachers, and building an online forum for APS educators. While some of the effort may fall within the regular level of effort by the APS Mathematics office and Department of Instruction, holding a professional development will require additional effort and expenditure. In addition, building an online forum will also require additional time, from both staff at the Math office and the Department of Information Services, and resources. However, we expect that the effort should cost $30,000 - 50,000.[4]

2.2 Recommendation #2: Ensure Presence of a Full-Time Math Coach in Every APS Elementary School.

Background

In 2008, the Arlington School Board approved funding in the FY09 APS budget to provide Math Coaches for every APS elementary school. The Math Coaches' primary role is to provide on-site, direct support to teachers by helping them effectively implement the APS math curricula and assist them in designing approaches to improve student achievement and instruction. Research has shown that professional development is most effective when it is ongoing and job-embedded and having Math Coaches present in each school ensures that research-based instructional strategies and differentiated math resources are incorporated thoughtfully into each APS classroom. As APS continues to grow their professional learning communities, the Math Coaches play an instrumental role. They strategically work alongside teams of teachers to help them design differentiated

[4] Four quarterly professional development (PD) sessions for 30 teachers would roughly cost about $12,000 in total if full day substitute teachers are provided for each teacher participating in the PD sessions. Cost of planning and presentation involving experienced external speakers for four sessions could be up to $20,000 in total (less if APS employees present instead—approximately $8,000). Cost of online forum creation involves additional staff time. We expect this would range between $10,000 and $15,000.

instruction for a wide range of diverse learners. Math Coaches work collaboratively with teachers in interpreting data to determine appropriate instructional responses. The coach helps teachers design long-range and short-range plans to meet the needs of students throughout our data driven school system.

Under the formula approved by the School Board in 2008, each elementary school would receive a minimum half-time person whose responsibilities would include helping classroom teachers improve their pedagogy and content knowledge in mathematics. The MAC had recommended this action in its 2008 report, and the ACI had ranked it highly that year. Since many APS elementary schools at that time already had Math Coaches, this action by the School Board added funds equivalent to 4.5 full-time equivalents (FTEs) to the APS budget.

In the 2008-09 school year, the APS Math Office moved aggressively to implement the Math Coach program in all elementary schools. By January of 2009 all APS elementary schools were supported by Math Coaches at the 0.5 FTE level or higher, and the system as a whole had 14.5 FTE specialists working with principals and classroom teachers to enhance mathematics instruction. The MAC recommended in its 2011-2012 Annual Report (and reaffirmed this recommendation in its 2013-2014 Report) that all APS elementary schools have a Full-Time Math Coach. As of this school year, 2015-16, only 11 of the 23 APS elementary schools had Full-Time Math Coaches (the eleven (11) schools are comprised of all Title 1 schools, i.e., those schools where a substantial number of students receive free or reduced price lunches, plus two non-Title 1 schools).

The addition of the Math Coaches has been embraced by classroom teachers and principals and Math SOL achievement in the 3rd, 4th and 5th grades has improved markedly after the two-year start-up period that academic research generally indicates is the amount of time needed for the effect of coaches to be felt.[5]

Recommendation and Rationale

The MAC recommends that every APS Elementary School be allocated at least one Full-Time Math Coach. The MAC continues to stand by its November 2013 and February 2012 recommendations that a full-time Math Coach should be ascribed to <u>each</u> APS elementary school. The increasing need for Mathematics fluency affects all students, not just those who attend Title 1 schools.

Currently, all elementary schools within APS have at least a "half-time" Math Coach while all nine Title 1 schools (i.e., those schools where a substantial number of kids require free or reduced price lunches) plus two other schools have an additional half-time Math Coach. While it may seem, on its face, that the Title 1 schools are where more support is needed to help students to achieve at the

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[5] Patricia F. Campbell, Nathaniel N. Malkus. "The Impact of Elementary Mathematics Coaches on Student Achievement." The Elementary School Journal, Vol. 111, No. 3 (March 2011), pp. 430-454.
This study is especially noteworthy because of its focus on Virginia SOL performance at the elementary-school level using schools where math coaches were randomly assigned. The researchers are based at the University of Maryland.

same levels as non-Title 1 schools, there is a substantial number of students in each APS elementary school that could benefit from additional coaching support provided to teachers.

The new Math standards are having a significant impact on elementary school Math curricula as well as those in middle schools, as topics have been pushed down into lower grades in order to accommodate the progression to 8th-grade Algebra I. Such a shift will drive the need for further math coaching support at the elementary school-level.

The achievement gap for the "economically disadvantaged" and the "student with disabilities" subgroups has been closing, on a raw score basis, between those schools that currently have full-time Math Coaches (e.g., Title 1 schools) and those who do not.[6]

Substantial APS Elementary School Population Increases

A strong factor supporting this recommendation is that the number of students within APS Elementary Schools has grown substantially over the past 5 years (about 25%). In addition, projections show that the APS Elementary School populations will be about 50% greater within the next 5 years compared to the time when the School Board approved funding for half-time Math Coaches in all APS Elementary Schools.[7]

Budget Impact

Currently, 12 APS elementary schools have only a 0.5-FTE Math Coach. Increasing these schools' Math Coach resource to a full FTE will require an additional 6 FTEs of new hires. Assuming a $90,130 planning factor for an FTE, this recommendation will require $540,780 of funding to implement during the 2016-17 school year. Or, in a less costly alternative given APS budgetary constraints, increase the Math Coaching complement in, say, four (4) of those non-Title 1 APS elementary schools that are consistently showing lower Math SOL scores to a full FTE. In such case, the funding required during the 2016-2017 school year would be $180,260.

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[6] We have analyzed data on average raw math scores for all APS Elementary Schools between 2004-05 and 2014-15. We grouped schools into two groups based on whether they now have full-time math coaches or not and examined the trend in average scores between the two groups. The gap in average math SOL scores between the groups has narrowed substantially since 2010-11, a period after the Math Coach program was fully implemented. These results are available upon request.

[7] Student population for APS Elementary Schools was 10,166 in 2008; such population is projected to increase to 15,045 by 2020.
http://www.apsva.us/cms/lib2/VA01000586/Centricity/Domain/11/Capacity_Utilization_Scenario1_NewES.pdf

2.3 Recommendation #3: Increase Transparency of Math Teaching Methods in Communications with Parents.

Background

Many parents have expressed concerns at not having sufficient information regarding the strategies taught in school in relation to various math concepts. This lack of information often leads to frustration as parents try to help their children with math homework or preparations for quizzes and tests. In addition, many APS parents may even lack the knowledge of the appropriate strategies to help their children. For these reasons, the MAC sees value in keeping parents informed of the math instructional methods being adopted and applied within APS schools, especially at the elementary school level.

Recommendation and Rationale

The MAC recommends that APS encourage or even require teachers, especially at the elementary school level, to increase transparency of math instructional methods by communicating them with parents. There are several methods of communications that APS could adopt (e.g., fliers in Friday folders, email, postings on Blackboard) in providing parents with such information.

It is hoped that some level of uniformity across APS schools could be adopted for such communications processes. The APS Math office could provide its teachers talking points setting forth fundamental instructional approach(es) for a given mathematics unit at the outset of its instruction to students. The teachers could then relay these points to parents to keep them abreast of the teaching methods their students are receiving. For example, when students begin to learn double-digit additions, teachers could send home a printed descriptions of the strategies students will be taught in class.

Budget Impact

Minimal budget impact.

3. Other Topics Under Study

During the 2015-2016 academic year, the MAC will build on the work it performed in 2014-2015 by further studying several topics that may serve as the basis for future recommendations. The APS district goals are at the forefront of the MAC's deliberation on such topics. Each topic is discussed below.

<u>Integrating Math Into Other Subjects</u>

One of the topics being considered by the MAC is the development of a K-12 STEM (science, technology, engineering, math) model by developing a STEM program (including instructional

training), e.g., through the Career Center, as well as partnerships with universities/industries requiring STEM education and training.

The MAC is also exploring ways to make the study of math relevant to the real world, i.e., broaden student learning to cover the relationship between math and art, design, dance, music and other areas. The MAC has also reached out to the Gifted Services and Science Advisory Committees to explore collaborative efforts on this front in the near future.

Develop "Students Tutoring Students" Approach at the Secondary Level

There may be a way to introduce a peer-tutoring approach which enables students to tutor fellow students, in a way that would not supplant teachers' and students' standard teaching/learning experience during the standard school day, but augments it. The student-on-student teaching model will provide opportunities for advanced math students to use and challenge their math skills to teach and help their peers who may be struggling in math. The MAC is aware of certain peer-tutoring programs such as those at Yorktown and Washington-Lee High Schools where students tutor peers through honor society service hours. . We will also look at possibly establishing pilot programs to encourage more participation of students as tutors and spreading the word on opportunities to connect such tutors with students seeking additional support outside of school.