Arlington Public Schools

# Mathematics Program Evaluation

## Executive Summary

January 2020

# EXECUTIVE SUMMARY

Arlington Public Schools (APS) conducts systematic evaluations of instructional programs on a six-year cycle to examine educational progress and ensure continuous improvement in the delivery of its strategic educational goals. This is the third evaluation of the Mathematics Program.

## About the Evaluation

The evaluation of the APS Mathematics Program began in 2016-17, during which a planning committee met regularly to develop the questions that would guide data collection. Committee members included staff from Planning and Evaluation, the Mathematics Office, other offices within the Department of Teaching and Learning, Mathematics teachers including Special Education and English Learner teachers, school administrators, and parents. Data for this evaluation was collected over the course of the 2017-18 school year. Important to note is there were certain mathematics pathways studied for this evaluation that APS no longer uses. Prior mathematics pathways allowed students to skip some content while the new pathways compact all mathematical topics in order to ensure students do not miss any mathematics content that is necessary for their future learning.

The evaluation centered on two overarching questions: 1) How effectively was the Mathematics Program implemented and 2) What were the outcomes for the targeted population?

Highlights from this study of the Mathematics Program include:

- Teacher-student interactions demonstrate effective instruction that correlates with best practices and long-term school success.
- APS is providing mathematics instruction that is purposeful and dynamic using relevant data and personalized learning opportunities to adjust and individualize instruction.
- Professional collaboration is happening regularly and contributes to student academic achievement and professional competence.
- There is a high level of student engagement in APS mathematics classrooms. Enrollment in advanced level mathematics courses and some AP classes has been increasing across all demographic categories.
- By the end of Grade 12, almost half of all APS students have taken an advanced or college-level mathematics course.

## Mathematics Program

The Mathematics Office provides system-wide leadership for curriculum, professional development, and required mathematics instruction at the elementary, middle, and high school levels. The Mathematics Office serves students in grades K-12, including students enrolled in Advanced Placement, International Baccalaureate, dual enrolled, EL, immersion, and special education courses.

The primary mission of the APS Mathematics Program is to establish and lead a culture of continual learning among teachers toward the implementation of best instructional practices and curriculum design, aligned to division and state goals, in order to challenge students to problem solve and think

for themselves, make real-world connections in order to access future opportunities and build successful lives, and engage in a purposeful community of learning.

## Methodology

The APS study uses a variety of informational and data sources to assess program implementation and effectiveness. The Classroom Assessment Scoring System (CLASS), developed at the University of Virginia's Curry School of Education, assesses the interactions between students and adults. The Mathematics Observation Tool, designed by APS Mathematics leadership, evaluates specific areas of content and content delivery used in mathematics classrooms. These two observation tools are complemented by the Mathematics Survey which provides further information about instructional practices and student outcomes and behaviors. A review of mathematics enrollment patterns, presented both as annual measures and within a longitudinal study, conducted for APS by the Hanover Research Council, provides information on the mathematics course trajectories students take over time. An evaluation of standardized testing results at the local, state, and national levels gives important feedback on program efficacy and future needs.

## Findings

*Instruction*

APS mathematics teachers employ best instructional practices in the classroom. They foster a positive learning environment and provide strong classroom organization. Students are receiving individualized instruction based on a variety of formal and informal assessment tools that help guide teacher planning and instructional strategies. Teachers rely primarily on student work and summative assessments to plan and adjust mathematics instruction for the needs of diverse learners.

Teachers indicate they are confident and competent in their knowledge and ability to present mathematical concepts to their students in a variety of modalities as well as to help students connect new learning to prior and future learning. There is regular professional collaboration occurring among mathematics team members, but less frequent collaboration is occurring with English Learner teachers, special educators, and the school resource teacher for the gifted (RTG).

Student engagement in APS classrooms is high. Behavior management and the efficient use of instructional time is observed to be strong at every grade level. Additionally, there is a focus on using clear, precise mathematical language in mathematics classrooms to promote effective communication both by the teachers when they instruct the students and by the students when they verbally demonstrate their understanding of mathematics concepts. A variety of instructional structures and strategies are used at every grade level and opportunities for students to show problem-solving ability are also seen at every grade level. More work is needed around the use of instructional dialog and feedback to students to promote higher-level problem solving and in-depth thinking skills.

*Enrollment*

Beginning at the earliest grades, assessments are used to ensure students are building the solid foundation of mathematical understanding necessary to progress through a mathematics course sequence that is challenging and appropriate. Preparing all students for success in advanced mathematics coursework and college-level classes is a priority for the Mathematics Office.

Student involvement in advanced and college-level mathematics courses in Grades 11 and 12 can largely be predicted by course enrollment in earlier grades. Enrollment in advanced courses at the middle school level is a good indicator of future participation in advanced and college-level courses in high school.

Enrollment in advanced courses is increasing among all demographic groups; however, there are notable differences in course trajectory pathways between members of different demographic subgroups. Almost 50 percent of APS students graduate high school having taken at least one college-level mathematics course. White, Non-Disadvantaged, Non-SWD (student with no disability) are overrepresented in advanced classes. Disadvantaged, Hispanic, Black, and SWD students are proportionately underrepresented in advanced mathematics courses. EL (English learner) students are also underrepresented. As their English language proficiency level increases so does their participation in advanced coursework.

Efforts continue to encourage and support students to take on the challenge of advanced mathematics coursework as they demonstrate appropriate readiness.

*Assessments*

Assessment data is consistently used to plan instruction and monitor student progression and enrollment.

In general, APS students are scoring at higher levels than state averages at every grade level in every mathematics course on Virginia Standards of Learning (SOL) assessments. Closer examination reveals, however, that there are many student groups that are passing the SOL at lower rates both at the Proficient and Advanced levels at each grade level. End of Course SOL results over the past five years show that Middle School students have very high pass rates for Algebra I and Geometry, both of which fall in the 95 to 100 percent range. Those pass rates are higher at the Middle School level than at the High School level for students taking those same classes.

The Kindergarten and Grade 1 Assessments indicate that at the earliest levels of education, students are seeing significant and consistent gains in their mathematics aptitude. EL, SWD, and Economically Disadvantaged students also see significant gains. Those gains result in a narrowing of the opportunity gap, but, in general, a 10 percent gap remains between EL, SWD, and Economically Disadvantaged students and their peers.

The Mathematics Inventory (MI) Assessment is a very reliable indicator of student performance and correlates well with other data points. MI results show that specific intervention for students testing below basic grade-level skill readiness has a demonstrable positive impact on performance.

APS AP Pass Rates for Mathematics Courses have been below state and national averages for the past four years. Overall student participation in AP classes has increased though some student groups, such as EL, SWD, and Black students have seen limited or stagnant enrollment.

IB Mathematics Pass Scores from the 2013-14 through the 2017-18 school years have ranged from 80 to 100 percent and generally fall in the mid to upper 90s for each of the three IB Mathematics courses.

## Recommendations

**Recommendation #1:** Provide growth and leadership opportunities by providing meaningful, high-quality, and relevant professional learning opportunities to support retaining and advancing high-quality employees.

- Continue to strengthen teacher content knowledge through job-embedded professional development provided by mathematics coaches, APS Content Academies, and university partnerships
- Strengthen the utilization of best practices through professional learning around
    - Mathematics Workshop
    - Content academies
    - Principal Institutes
    - Mathematics coaching
    - Lead Teacher & Department Chair development
    - Secondary Mathematics countywide learning opportunities
- Co-teaching in collaboration with the Office of English Learners, the Office of Special Education, and the Office of Gifted Services
- Create a universal professional learning plan for teachers, coaches, and administrators
- In collaboration with the Office of English Learners and the Office of Special Education, encourage mathematics teaching staff to earn educational credits and/or an endorsement in the areas of English Learner Education and Special Education to improve teaching pedagogical practices for all students
- Support teachers and coaches working toward Mathematics Specialist endorsements

**Recommendation #2:** Allocate staffing for more Mathematics Coaches at the elementary and high school levels and sustain allocations at the middle school level. Mathematics Coaches work to

- Improve student achievement and address the opportunity gap through the improvement of instruction
- Work with administrators, teachers, students, parents and the community toward meeting APS mathematics goals
- Support the self-directedness of individual teachers and/or teams of teachers through coaching, consulting, and collaborating

- Assist teachers in interpreting data and with incorporating strategies to improve student achievement and instruction
- Promote teachers' delivery and understanding of the curriculum through collaborative long-range and short-range planning
- Facilitate teachers' use of successful, research-based instructional strategies, including differentiated instruction for diverse learners
- Meet regularly with school administration to review data and plan
- Collect data through observation of instruction to support teachers in planning and reflecting
- Engage in research-based professional development and applies learned professional development practices
- Assist in development of curriculum and assessment resources
- Prepare and delivers staff development related to APS Mathematics Office
- Support the work of the school's leadership team by representing the mathematics lens and advocating for high quality instructional practices
- Engage in his/her own learning and planning to prepare for support of teachers and teams
- Promote equitable teaching practices

**Recommendation #3:** Develop curriculum guides and documents that integrate instructional approaches focused on improving student achievement in all demographic groups, in collaboration with other Teaching and Learning Offices, such as Gifted, English Learner, Special Education, Personalized Learning, and the Arlington Tiered System of Support to

- Provide research-based curricular materials aligned to current standards
- Deploy research-based interventions and curricular support for targeted groups such as English learners, students with disabilities, and students above or below grade level
- Offer professional learning to promote personalized learning opportunities in the classroom
- Provide opportunities that support teacher with depth and complexity in instruction
- Provide intentional opportunities for students to read, write, speak, and listen within curriculum documents and resources

**Recommendation #4:** Provide multiple pathways for success to all students by creating access to advanced and college level courses in a variety of ways.

- Design a flexible Mathematics Program that includes modules, course options, and courses with a compacted curriculum which allow students to demonstrate readiness for college level classes or advanced coursework at their own pace
- Create a comprehensive vertical articulation that leads to increased depth and complexity at the elementary level with the goal of comprehensively preparing students for more rigorous middle school coursework

- Create a comprehensive vertical articulation that leads to increased depth and complexity at the middle school level with the goal of comprehensively preparing students for more rigorous high school coursework
- Explore additional ways to compact high school course material
- Utilize technology to augment instruction and support access to advanced mathematics courses
- Work with all stakeholder groups to ensure common understanding of the role of additional depth and complexity and course progressions, including
    - Students
    - Families
    - Teachers
    - Directors of Counseling and Counselors
    - Administrators