Arlington Public Schools

Science Program BRIEFING REPORT

APRIL 2021

SCIENCE PROGRAM

The APS Science Program serves to inspire an enthusiasm for scientific literacy, to foster an inquisitive spirit in learners through inquiry-based experiences in real-life contexts, and to create a community of scientifically and environmentally literate individuals who are able to make informed decisions.

MAJOR SERVICES PROVIDED

- Develop, revise, and enhance curriculum and instructional programs; identify and create teacher resources that support a rigorous curriculum aligned with state standards.
- Monitor instruction and program implementation; promote high quality instruction through observation and feedback cycles for teachers.
- Facilitate and coordinate high quality professional development for staff that focuses on best practices in pedagogy.
- Sponsor, organize, and manage the Northern Virginia Regional Science and Engineering Fair.
- Organize and support student participation in state and national science competitions, such as the Virginia Junior Academy of Sciences (VJAS), the Virginia State Science and Engineering Fair (VSSEF), and the Regeneron International Science and Engineering Fair (ISEF).
- Develop and maintain chemical and safety management plan; coordinate the inventory, management, and disposal of chemicals at middle and high schools.
- Administer and manage the Planetarium and the Outdoor Lab programs, including curriculum, purchasing, transportation, and delivery of services for school field trips.
- Coordinate the Scientists in the Classroom program that enables STEM volunteers to support classroom instruction.

BRIGHT SPOTS

MIDDLE SCHOOL PROGRESSION MODEL FOR INDEPENDENT SCIENCE RESEARCH

The Science Office revised the independent science research model for the middle school program to provide our students with greater consistency and support. This progression model gradually builds on research knowledge and skills at each of the grade levels with all students conducting projects in the 8th grade as their capstone experience. Middle schools are transitioning to this independent science research model next year and full implementation will occur during the 2022-2023 school year.

DEVELOPMENT OF THE ARLINGTON ENVIRONMENTAL LITERACY PLAN

The Science Office, in collaboration with multiple stakeholders, has developed the Arlington Public Schools' Environmental Literacy Plan, which is the first to be developed for a school division in the Commonwealth of Virginia. The goal of the Environmental Literacy Plan is to ensure that our students acquire the knowledge, skills, and dispositions to solve problems and resolve issues individually and collectively to sustain ecological, economic, and social stability. The APS Environmental Literacy Plan aligns with VDOE's Profile of an Environmentally Literate Graduate. Other school divisions are working to develop their own Environmental Literacy Plan, and the state is using APS as a model program.

VIRTUAL PROGRAMS AT THE OUTDOOR LAB

For many students, the Outdoor Lab stands out as a highlight in their APS experience. Despite limitations due to Covid-19, the Outdoor Lab continues to support APS classes through synchronous programming. These virtual programs and activities are designed to replicate a trip to the Outdoor Lab for grades 3, 5, and 7. The content materials are aligned with the Standards of

Learning for each of these grade levels. In addition, the Outdoor Lab staff have created a series of asynchronous modules that are archived and can be used at any time to support instruction.

NATIONAL DISCUSSION ON CULTIVATING AN INCLUSIVE CLASSROOM

Science teachers from Wakefield High School served on a national panel discussion to talk about education equity. The teachers shared ideas, insights, and perspectives on promoting an equitable, inclusive STEM classroom. They also discussed challenges and barriers to achieving equity and shared practical ideas to encourage inclusivity. The "I Can Be A Scientist Too" panel discussion is part of the American Chemical Society webinar series.

APS STUDENT NAMED REGENERON SCIENCE TALENT SEARCH FINALIST 2021

Washington-Liberty High School senior James Licato has been named a finalist in the Regeneron Science Talent Search 2021, the nation's oldest and most prestigious science and math competition for high school seniors. Licato's research project is: Development of a Zeolite Composite Material for the Simultaneous Removal of Pharmaceuticals, Personal Care Products (PPCPs), and Perfluorinated Alkyl Substances (PFAS) in Water Treatment.

APS STUDENTS EXCEL IN SCIENCE COMPETITIONS

Due to school building closures last year, the 65th Northern Virginia Regional Science and Engineering Fair was held virtually in April 2020. The annual regional science fair was open to students in grades 7-12 from Arlington Public Schools, Alexandria City Public Schools, Falls Church City Public Schools, and the private schools within those jurisdictions. Over 200 APS students participated in the virtual fair. Fourteen APS students were nominated and competed in the Virginia State Science and Engineering Fair (VSSEF), which was also conducted virtually. At the middle school level, fifteen seventh and eighth grade students were nominated for the Broadcom MASTERS, a competition sponsored by the Society for Science and the Public.

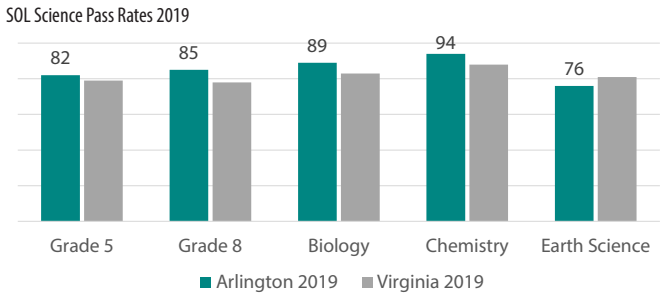
The 79th Virginia Junior Academy of Sciences (VJAS) was also held virtually last year. A total of 145 student research papers were accepted to VJAS, which represented nearly a quarter of the VJAS participants among all school divisions statewide. The VJAS competition provides students an opportunity to present their papers to university professors and science experts and to engage in scientific discourse to further explore their topics.

Final preparations are being made for the 66th Northern Virginia Regional Science and Engineering Fair which will be held virtually this month. Students across the school division will compete for numerous awards from different organizations and an opportunity to enter the Virginia State Science and Engineering Fair and the Regeneron International Science and Engineering Fair.

DATA THAT PROVIDES INSIGHT

VDOE STANDARDS OF LEARNING IN SCIENCE

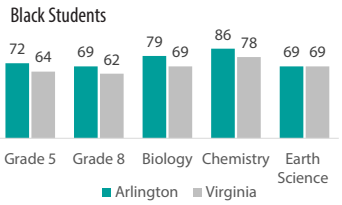
The SOL assessments were not administered in spring of the 2019-20 school year due to the COVID-19 school closure. The data below is from the 2019 SOL administration. Arlington Public Schools outperformed the state in four of the five science SOL tests, including Grade 5 Science, Grade 8 Science, Biology, and Chemistry. APS outperformed the state by seven points for Grade 8 Science, and by six points for both Biology and Chemistry.

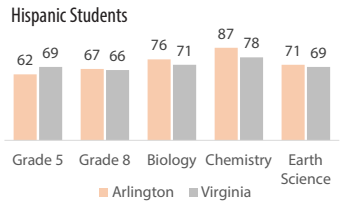


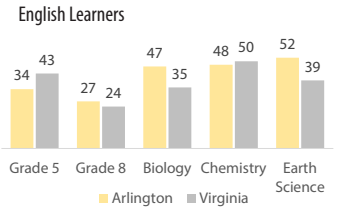
Students entering 9th grade in the 2018-19 school year and beyond, now only need one verified credit in Science to meet the graduation requirements. Biology has been designated as the course for which students will take the End of Course SOL exam. This means that fewer students are taking SOL exams in Chemistry and Earth Science. This has provided APS science teachers with more flexibility to use a balanced assessment approach that includes a variety of tools by which students can show mastery of skills and content.

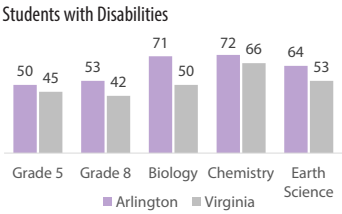
APS SOL science pass rates for all sub-groups were generally higher than the state. Black students outperformed the state in the Biology test by ten points. In Chemistry, Hispanic students outperformed the state by nine points. Students with Disabilities outperformed the state by 21 points in Biology, and by 11 points for both Grade 8 and Earth Science. However, Hispanic, English Learners, and Economically Disadvantaged students performed lower in Grade 5 Science when compared with the state.

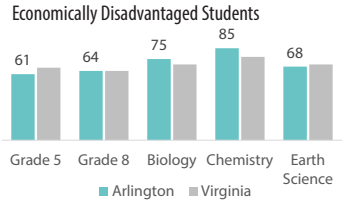
SOL Science Pass Rates 2019





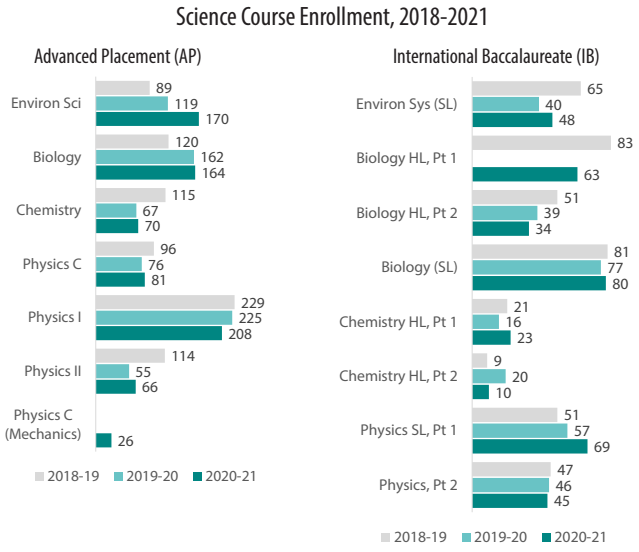






AP/IB SCIENCE COURSE ENROLLMENT

Enrollment numbers in AP and IB Science courses increased this year. The enrollment in AP Science classes increased by 11%, as compared to last year. IB Enrollment also continues to rise from the previous year, increasing by 26%.



ONGOING WORK

CURRICULUM REVISION AND IMPLEMENTATION

With the adoption of the new 2018 Science Standards of Learning, the Science Office is in the process of reviewing and revising the APS science curriculum documents to ensure alignment.

The Science Office is part of the first group of content offices to participate in training on Dr. Gholdy Muhammad's Historically Responsive Literacy Framework. Using the model from this training, the Science Office will review our science curriculum maps and resources to ensure inclusivity and accessibility for all students.

DEVELOPING AND IMPLEMENTING BALANCED ASSESSMENTS

Balanced assessments provide our students with many different types of evaluations that measure student achievement and growth based on content standards, specific learning goals, and the 5 C's (critical thinking, creative thinking, collaboration, communication, and citizenship skills). The APS Science Program is moving towards expanding the use of these types of assessments. Currently, local alternative assessments are required for Science Grade 3. The Science Office, in collaboration with teams of teachers across content areas, is developing additional performance assessments to make them available for grades K-12. The development, refinement, and implementation of these assessments will complement our curriculum once it is revised to align with the new Science Standards of Learning.

CULTIVATING COMMUNITY PARTNERSHIPS

The Science Office is continuously building and cultivating partnerships to support science education in APS.

- In addition to our partnership with the Arlington Outdoor Education Association, the Science Office is partnering with the Arlington County Department of Parks and Recreation to provide science programming for elementary students. Naturalists from Gulf Branch and Long Branch Nature Centers have provided virtual classroom visits and demonstrations for our elementary school students.
- As part of our Scientist in the Classroom program, fourteen STEM professionals continue to support our elementary classrooms virtually and have already volunteered over 1,000 hours this year. This includes providing lab demonstrations, leading small group instruction, and supporting science nights.
- The National Wildlife Federation has developed online learning modules and professional learning opportunities on Meaningful Watershed Educational Experiences (MWEE) for our teachers.
- The Science Office continues to partner with the Friends of the Planetarium to plan for the reopening of the David M. Brown Planetarium, including the development of additional program and show offerings.

WHAT WE LEARNED

INDEPENDENT PROJECTS

Independent science research requirements at the middle school level have varied from school to school. There is a need for greater consistency of expectations and support for students. By having a district-wide independent research progression model, all middle school students will have opportunities to learn about scientific research methods and be able to apply these skills to areas of interest. Middle school teachers will have opportunities to scaffold scientific skills, including experimental design, at each of the grade levels. There will also be more opportunities for teacher collaboration.

STANDARDS-BASED GRADING AND INSTRUCTIONAL TIME FOR ELEMENTARY SCIENCE

Science instructional time and content delivery have been inconsistent among APS elementary schools. Additional time dedicated to science instruction is needed. The implementation of Standards-Based Grading at some of the elementary schools has translated into some increased time allocated for science instruction. In addition, teachers are more likely to use the district-wide science pacing guides. To assess efficacy, the Science Office will seek additional feedback from teachers on Standards-Based Grading for science, including time requirements and fidelity of implementation.

PERFORMANCE ASSESSMENTS

When the Science Grade 3 SOL test was eliminated several years ago, the Science Office began developing and implementing performance assessments. All third graders are now using performance assessments as part of the Local Alternative Assessments. There remains, however, a need to further expand the use of performance assessments as a way to measure student learning in science. These assessments are valuable tools that allow students to demonstrate their understanding of scientific content and skills through applications. APS will need to invest in resources for developing these assessments, as well as professional learning for teachers to ensure valid and reliable scoring and implementation.

SCIENCE COURSE PLACEMENT

With the changing Science SOL testing requirements, it is important that students receive appropriate guidance and placement for science courses. For example, high schools may recommend students enroll in Environmental Science as a more appropriate class than starting with Earth Science. The Environmental Science course provides students with ample opportunities to build on scientific skills and practices.

Upon successfully completing it, students will have the option of choosing a Biology or Earth Science credit toward graduation. By providing students with different course options to earn science credits, they will have greater flexibility to fulfill their graduation requirements.

MOVING FORWARD

The work of the Science Office will include the following:

1. Provide professional learning for teachers on the Middle School Progression Model for Independent Projects.
2. Complete the revision of the science curriculum documents; align with the new VDOE Science SOLs; and ensure inclusion and accessibility based on Dr. Gholdy Muhammad's Historically Responsive Literacy Framework. Emphasis
3. Refine and monitor performance assessments in Grades 3-5. Expand the use of performance-based assessments into the secondary level, along with developing rubrics that can be used to track student growth.
4. Continue to provide science teachers and Sustainability Liaisons with MWEE training and support that is necessary to advance environmental literacy for all APS students.