

MEMORANDUM

TO: Arlington School Board
FROM: Science Advisory Committee
DATE: March 31, 2011
SUBJECT: Non-recommending Year Report

Current Year Activities:

The activities of the committee for this year included:

- **Review of the Science Standard of Learning (SOL) Scores for Elementary, Middle, and High School Students**

The Science Advisory Committee spent the majority of committee time this year evaluating the scores from the spring 2010 science SOL tests. APS science SOL scores were compared to average science SOL scores in Virginia and other area school districts. In addition, the Science Advisory Committee was able to review APS scores for each school, selected grades and classrooms. To avoid breaking confidentiality for students, this review was anonymous. Science SOL scores were reviewed with respect to various demographic cohorts (students who are white, Asian, Black, Hispanic, Limited English Proficient, Economically Disadvantaged, and Students with Disabilities.)

- **Elementary School**

Figure 1: Science Grades 3 and 5 SOL Passing Rate (2010)

District	Grade 3	Grade 5
Arlington	93	88
Virginia	91	88
Alexandria	85	83
Fairfax	92	88

- APS Students met or surpassed the Virginia average passing rate for Grade 3 and 5.

Figure 2: Science Grade 5 SOL Passing Rate by Demographics (2010)

District	White	Hispanic	Black	Asian	Economically Disadvantaged	Limited English	Disability
Arlington	98	74	79	86	74	73	65
Virginia	93	78	79	93	79	73	69
Alexandria	97	75	80	81	78	72	62
Fairfax	95	71	75	93	70	72	70

- Generally, APS white students outperform other districts' white students; however, students who are Hispanic, Black, Asian, economically disadvantaged and Students with Disabilities lag behind the performance of students who are white in Arlington County as well as their counterparts in other districts.
- We noted six of the twenty two elementary schools have a Grade 5 Science passing rate of less than 80%. The passing rate range of selected school scores was from 52% to 100%. The Science Advisory Committee was concerned with the variation of scores within APS, but we are most concerned with the six schools that scored between 52% and 76%.

○ **Middle School**

Figure 3: Science Grade 8 SOL Passing Rate by Demographics (2010)

District	White	Hispanic	Black	Asian	Economically Disadvantaged	Limited English	Disability
Arlington	97	79	85	88	76	72	72
Virginia	95	83	85	95	84	77	71
Alexandria	93	78	87	87	81	74	64
Fairfax	98	81	86	95	82	80	77

- The Science Advisory Committee noted that Middle School scores reflect the same demographic pattern as noted in the elementary school scores; APS students who are white generally outperform other white students from other districts and those of other demographic cohorts. Students who are Black, Hispanic, economically disadvantaged, Limited English Proficient and students with disabilities in APS lag behind similar students in other school districts.
- All APS School Passing Rates are above 82%.

- **High School**

Figure 4: Science End of Course SOL Passing (2010)

District	Earth Science	Biology	Chemistry
Arlington	86	88	91
Virginia	88	89	93
Alexandria	79	77	95
Fairfax	94	92	92

The Science Advisory Committee noted that there are differing participation rates in AP Science classes according to demographic cohorts. We are concerned that the in class learning experience as quantified in performance on the SOL in elementary and middle school predisposes the variation in participation in AP Science classes across demographic cohorts.

The APS Science staff has decided to transform content and curriculum of Physical Science (8th grade) summer school course to focus on chemical interactions and microbiology in the context of the Physical Science Standards of Learning. The rationale for this change is to provide strengthening for students in concepts and content likely to be presented to the students in 9th grade science courses. The Science Advisory Committee supports this change and plans on evaluating the effects of this course on performance in high school science classes for these students.

- Currently, success in summer school after 8th grade does not predict success in high school Biology
 - More than 54% of students who took Physical Science during the summer earned a B or higher
 - Only 9% of those same students earned a B or higher in Biology during the 1st quarter in the subsequent school year

Looking at the APS SOL data for 2010, the Science Advisory Committee, in conjunction with our Staff Liaison and Science Specialist, would encourage APS to consider different approaches to improving science instruction and supporting teachers who teach science. Some options to consider would be

- Provide targeted professional development for the teachers
- Encourage the use of integrated projects or lessons
 - Combine curriculum objectives of projects and lessons involving creative arts, language arts (both reading and writing), keyboarding/computer classes, math classes, and science classes

- Encourage elementary teachers to ensure adequate time for science, we suggest using interdisciplinary projects or lessons
- Provide adoption of benchmark science assessments to all students in fourth and fifth grade to inform instruction of students and ensure teaching of science content
- Provide pacing guides to teachers that are reflective of assessments
- Provide follow-up or intervention for classes with poor assessment scores

Throughout this activity, the Science Advisory Committee was impressed with the potential of analyzing the SOL test results. The Science Advisory Committee encourages the Arlington Public Schools to continue to utilize the SOL data to mediate improvement of science education throughout APS. The Central Offices should continue to mine the data and identify student groups that are thriving and those that are failing, it could identify teachers who have had success in the class room and those that could benefit from some interventions. Identification of successful teachers could allow the sharing of best practices among colleagues. Appropriate use of these SOL results could improve efficiency and be useful in closing the achievement gap noted throughout the school system.

- Science Curriculum in the ESOL/HILT Context

The Science Advisory Committee met with ESOL/HILT science specialist, Jennifer Powell. Ms. Powell described how science is taught in elementary, middle, and high school students who are enrolled in the ESOL/HILT programs. Ms. Powell described the overall approach that APS takes to ESOL and HILT and how that approach affects science education for those students. Additionally, Ms. Powell described several interdisciplinary units that these students use, which could be adapted more widely for interdisciplinary instruction of mainstream classes or science focused summer school courses.

- Gifted Services Committee

Representatives of the Gifted Services Committee discussed with the Science Advisory Committee their recommendation to restore intensified class options in all core subjects at the middle and high school levels and implement achievement grouping at all levels, with grouping in all subjects by third grade.

The Science Advisory Committee endorses the philosophy that all students, regardless of ability level, are entitled to an education that challenges each student to achieve to his or her potential. We support this philosophy for science courses taught within the APS. Due to how science is taught in elementary, middle, and high schools within APS, these recommendations are most relevant to science in the middle school and entry level high school courses. The Science Advisory Committee suggests that the use of Intensified Courses, particularly those that are inquiry driven, for middle school should be considered as APS looks at the restructuring of middle school.

- 4-H Embryology *Beginning of Life Project*

The Science Advisory Committee met with a group of concerned parents regarding the use of fertilized chicken eggs to teach embryology and vertebrate development to Arlington County Schools. The parents presented their concerns about the potential for inhumane care of the chicks and the mental and health risks posed to APS students by the *Beginning of Life Project*. The 4-H Embryology Project is an optional program run through the 4-H extension office. In the past, some APS schools participated in the program; however as there is currently no 4-H extension staff in charge of this program, this program is not currently available to the APS. In general, the Science Advisory Committee supports the goals of this program. We think participation in this program should remain voluntary for schools and classrooms and dependent on teacher training.

**Update of Previous Recommendations:
Recommendation #1:**

The teachers and the APS staff should "unpack" the Scientific Investigation, Reasoning, and Logic SOL (6.1, 7.1 and 8.1) and develop grade level appropriate concept standards to be incorporated in science project modules. Each standard should be appropriate for a particular grade and in the vertical curriculum. (Grade 6 to Grade 7 to Grade 8)

- APS Staff "unpacked" the 2010 Scientific Investigation, Reasoning, and Logic SOL. They also created a Nature of Science instrument for distribution to Middle School Science Teachers, which presents concepts and then grade appropriate skill statements from each strand.

Recommendation #2:

Middle School students should participate in science projects that are inquiry-based, tied to the curriculum, and increase in breadth, depth, and scope throughout their middle school years. These projects should be integrated into the class curriculum. Science curriculum modules that include science projects should be developed by Arlington Public School staff and teachers. When developing these science curriculum modules the teachers and staff should emphasize skills and knowledge represented in the Scientific Investigation, Reasoning, and Logic SOL (6.1, 7.1 and 8.1).

- The Science Advisory Committee strongly supports the use of inquiry based science projects. Science Fair projects were highlighted in the most recent State of the Union Speech given by President Obama. The Science Advisory Committee plans to continue to investigate how to inspire APS students and improve science education with the appropriate use of inquiry-based science projects. We plan on evaluating the effects of inquiry-based science projects

on Scientific Investigation, Reasoning, and Logic SOL (6.1, 7.1 and 8.1) scores.

Recommendation #3:

Remove the Middle School Science Fair student participation from the Northern Virginia Regional Science Fair.

- Although this recommendation was not well received by the ACI, the Science Advisory Committee will continue to investigate how to increase participation in science fairs. We also plan on looking at the Scientific Investigation, Reasoning, and Logic SOL scores for those schools where participation in a Science Fair is part of the Science Curriculum.

Committee members:

Rolf Blank, Jeffery Coupe, Herb Fontecilla, Raquel Girvin, Holly Krull (Chair), Tina Kuklenski-Miller, Dat Le (Science Specialist), Aaron Manka, Betsy Morse (ACI Liason), Pamela Outz, Connie Skelton (Staff Liaison), Alan Tessier, and Mary Van Dyke