

## MEMORANDUM

**TO:** Arlington School Board  
**FROM:** Science Advisory Committee  
**DATE:** March 22, 2013  
**SUBJECT:** Non-recommending Year Report

### **Current Year Activities:**

Since our last report for the school year 2011-2012, (Recommending Report), the Science Advisory Committee (SAC) has spent the majority of its time participating in the process to adopt new science textbooks for the Arlington Public School (APS) elementary grades, K-5. We also have continued to examine other aspects of science education in APS, with a focus on elementary and middle schools. Our activities and findings for this year are organized below as 5 topics, several of which we expect will lead to formal recommendations in our report next year.

1. APS elementary grades currently use science textbooks that are more than 7 years old. The coverage of science topics in these books is dated, they are worn, the supply does not meet the current student demand, and they lack links to digital resources for both teachers and students. SAC was pleased to see APS invest the effort and funds to purchase new books for the next school year.

Beginning at the start of the school year, SAC participated in the evaluation of materials supplied by the four (4) vendors competing for the contract to provide science books and services to APS grades K-5. Although each of the four vendors covered the topics needed to prepare students for the Virginia science SOLs, they differ greatly in type of materials. One provided all digital materials, which would require elementary students go online to access the materials. Although their video materials were attractive, SAC felt that since many APS families have limited access to the internet coupled with potential software incompatibility and other technical issues, this was not a viable option at this time. Another vendor emphasized the use of kits for hands-on learning, which was popular with several teachers, but we agreed with the majority of teachers who felt that the learning curve for effective use of these materials would be too steep throughout the school system. Therefore, SAC endorsed the decision to eliminate these two vendors from the vetting process. However, SAC advised APS to continue to provide kits to those teachers who would make effective use of them.

The remaining two vendors each offered a combination of textbooks and associated online resources for teachers and students. SAC provided its own evaluation of these materials to the APS science staff, reviewed evaluations conducted by teachers from individual APS schools, and attended a final meeting with lead science teachers, which included presentations by the two vendors, prior to APS staff reaching a final decision.

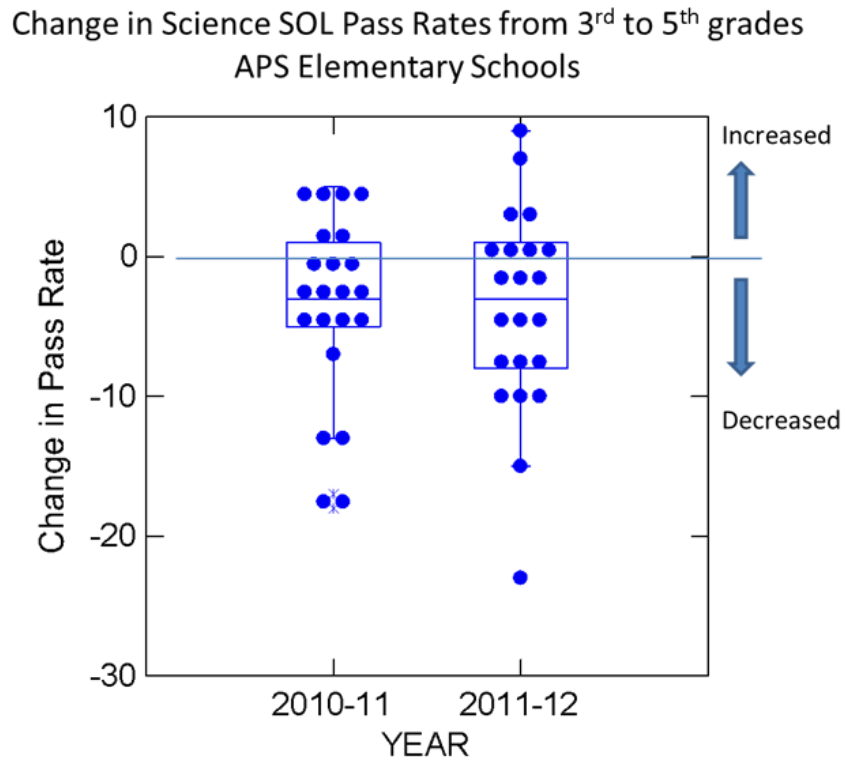
SAC fully endorses the final decision and hopes APS will move ahead quickly to secure the textbooks and other resources in time for the start of the next school year. The process used by APS to pick new science teaching materials was open and transparent, with substantial opportunity for input from teachers and parents. The community was invited through PTAs and individual elementary schools to review the vendor's materials and provide feedback. We were somewhat surprised at how little parent input was submitted beyond our own, but pleased with the overall process and final consensus decision on which vendor to select.

- Over the course of many reporting cycles, SAC has been investigating science education in elementary schools. As reported in the last evaluation of the APS Science Education Program in 2007, science instruction times are highly variable and unpredictable among APS elementary schools. Additionally, findings by the Center on Education Policy, reported national data showing that as elementary schools strive to reach goals in reading and math, instruction in other subjects has been decreasing.

Last year, SAC reported SOL data showing that many APS elementary schools suffer a drop in SOL science pass rates between 3<sup>rd</sup> and 5<sup>th</sup> grade while math and reading scores are largely unchanged. This pattern repeated this year. Figure 1 shows that more than 50% of APS elementary schools have lower science SOL pass rates in 5<sup>th</sup> grade compared with 3<sup>rd</sup> grade. More than 20% of the schools drop more than 10 percentage points.

**Figure 1**

Figure 1 is a box plot in which the data (individual dots for each of the 22 elementary schools) represent the difference in pass rates between grades 3 and 5 (i.e., pass rate for grade 5 minus pass rate for grade 3). Negative values indicate lower pass rates in 5th grade. The box plot boundaries denote the 1st (25 percentile) and 3rd (75 percentile) quartiles, and the horizontal dividing line represents the median. The horizontal line through the entire plot shows the expected value of zero change if 5th and 3rd grade pass rates were similar.



We note that not all schools show large drops in science SOL pass rates between 3<sup>rd</sup> and 5<sup>th</sup> grades; a few even increase. But the fact that the overall patterns has remained unchanged for some years suggests that science teaching is sacrificed in a number of schools during 4<sup>th</sup> grade, when no science SOL is taken.

Both this year and last year, bills were considered in the state legislature to eliminate the science SOL requirement for 3<sup>rd</sup> grade. SAC remains strongly opposed to this, as does the Virginia Association of Science Teachers. Whenever possible, APS should make clear to our state representatives the importance of science in the elementary curriculum and for treating it on par with other core subjects in regards to benchmarking and monitoring of science instruction and learning through elementary grades.

3. Inconsistency in science instruction during elementary school is likely the result of trading off limited instruction time among multiple instructional needs and enrichment activities. One general solution that we suggested in past reports is to better integrate science with the teaching of other subjects. Last year we recommended a pilot project to integrate reading with science by creating a K-5 non-fiction reading list that includes scientific topics or biographies, complementary to the K-5 novel reading list. APS teachers and staff worked to prepare that set of science readings linked to grade level and SOL reading standards. The resources – Infusion of Literacy - are available online <http://www.apsva.us/Page/19272>

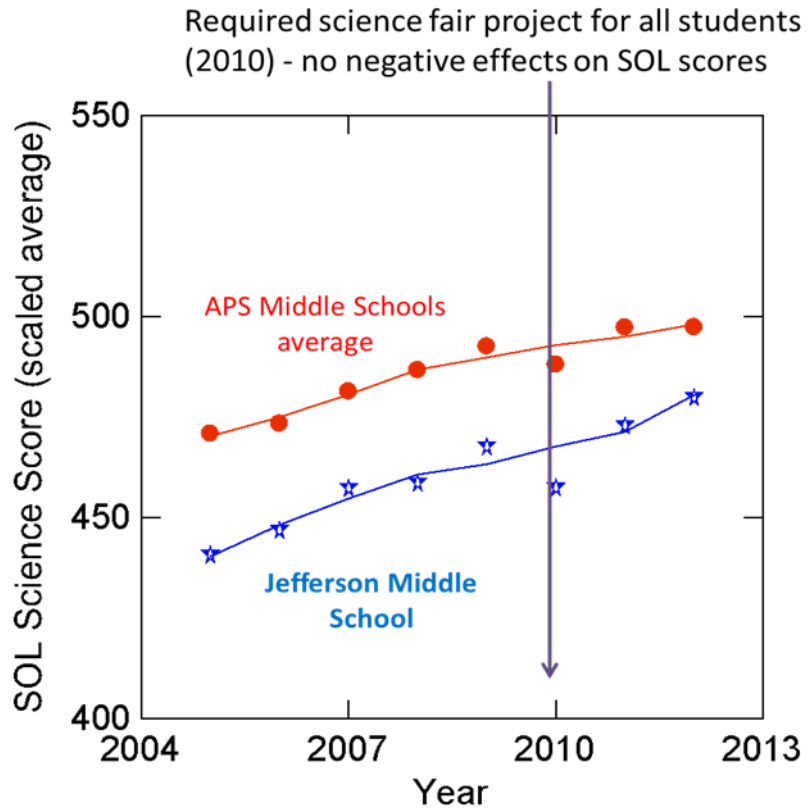
SAC surveyed elementary school teachers to see whether they were aware of the Infusion of Literacy project and whether they thought it was useful. Of the 138 respondents to the survey, only 28% were aware of the project, and only 21% had visited the website. However, of the 9% of respondents that made use of the books in their classrooms, there was much positive feedback. There was also strong support for expanding the project to include more book options. SAC will continue to monitor this project and work with APS staff to improve and more broadly advertise these resources, and encourage their use by APS teachers.

4. Another issue that SAC has long focused on has been independent science projects, particularly the consideration of a middle-school requirement for an inquiry-based science project and participation in science fair. We have made this recommendation in each of our reports for the past 5 years. The most common argument against a required science project is the perception that teachers could not take time from preparing students for the science SOL tests to help them with such a project.

SAC has been following outcomes following the bold decision by Jefferson Middle School to require all students, grades 6-8, to undertake a science project and participate in science fair each year. This new requirement was put in place starting with the 2009-10 school year. If the concerns of negative impact on science instruction were real we would expect to see lowered SOL test scores compared with the other APS middle schools. As shown in Figure 2, this was clearly not the case.

**Figure 2**

Figure 2 shows the average science SOL scaled score across all APS middle schools and just for Jefferson Middle School for each test year. In 2010, scores in all schools dropped slightly otherwise there has been a continuous improvement with some indication that Jefferson is catching up to the other schools.



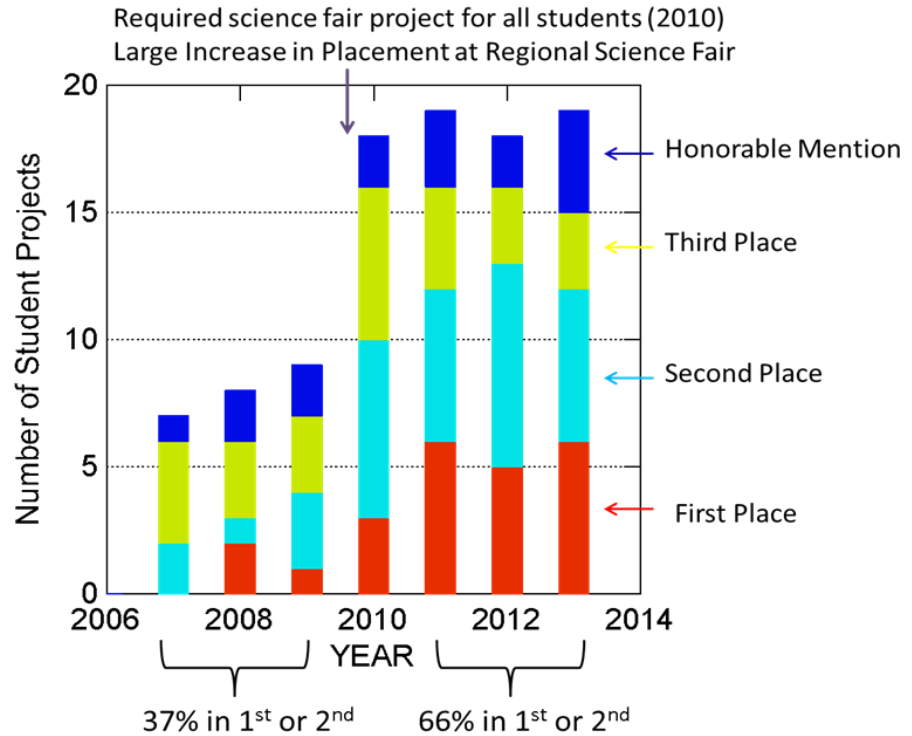
SOL pass rates at Jefferson have continued to improve, tracking the overall rise of the other APS schools, with no apparent negative impact from the requirement of all students to participate in science fair.

There are good reasons to believe that involvement in an independent science project can promote science education and enthusiasm for science. In fact, there are strong indications that the Jefferson experiment of a required science fair project for all students is having positive benefits.

The middle schools are allowed to send ~20 students each year to the Northern Virginia Regional Science Fair and Jefferson has sent that many in each of the last 3 years. But before the requirement went into effect, e.g., 2006-2009, only about half that many students were being sent to regional science fair from Jefferson Middle School. Figure 3 shows Jefferson Middle School student placement in the regional science fair, before and after the requirement went into effect. Note that before 2010, only ~8 students placed in Honorable Mention or higher from Jefferson and only ~3 of those placed in the top two categories at regional fair.

**Figure 3**

Figure 3 is a stacked bar plot, in which each bar shows the number of students from Jefferson Middle School whose projects placed at each of the last 7 annual Northern Virginia Regional Science Fairs. The 4, colored, groups within each bar show the number of students who placed in first, second, third, or honorable mention categories from the regional science fair judging.

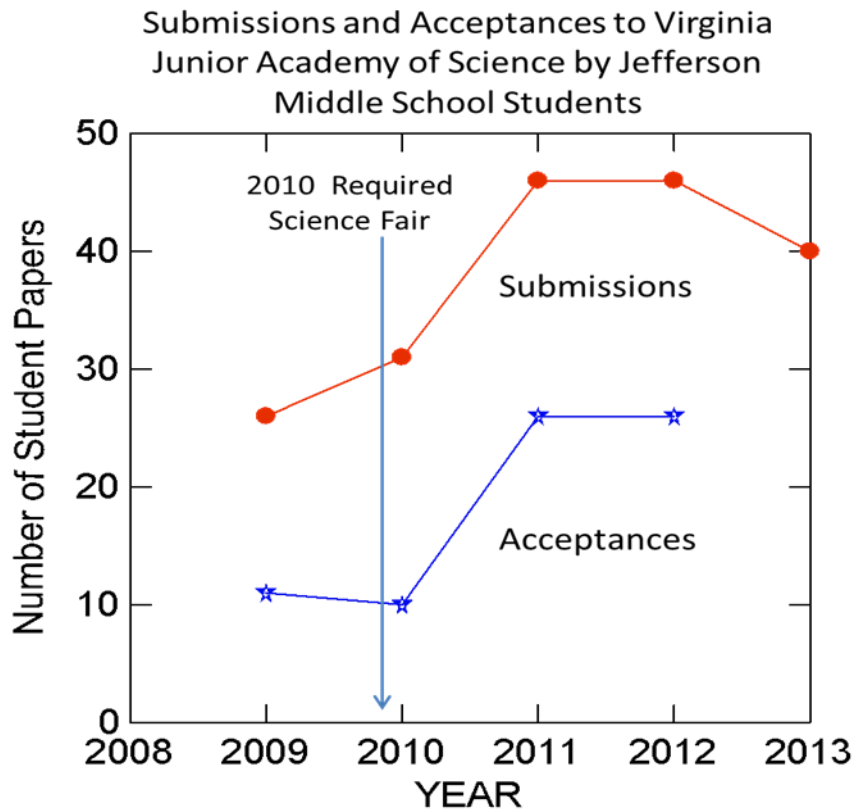


In the past 3 years, since the requirement was implemented, the number of students from Jefferson placing in Honorable Mention or higher has more than doubled. More importantly, the number of students placing first or second has more than tripled; more than half the students at regional science fair from Jefferson now earn a first or second place. This is an amazing achievement.

The impact of this type of positive feedback on middle school students should not be underestimated. In addition to gaining skill in conducting independent projects and confidence in presentation of their results, there are signs of increased enthusiasm for science among Jefferson students.

Although science fair projects are required at Jefferson, the decision to write up a project as a paper for submission to the Virginia Junior Academy of Science (VJAS) is a purely optional decision by the student. As shown in Figure 4, not only has the number of submissions by Jefferson students to VJAS jumped in recent years, the number of successful acceptances to attend the VJAS conference has doubled.

**Figure 4**



The Jefferson Middle School science fair requirement was a courageous move that undoubtedly imposed a significant amount of additional work on the science teachers. They should be commended for their efforts because the evidence is strong that this is having a positive effect of enhancing both science education and enthusiasm for science.

SAC will continue to examine the relationship between science fair participation and other science learning outcomes at Jefferson and at other middle schools. For example, Kenmore Middle School recently imposed a similar requirement on 7<sup>th</sup> and 8<sup>th</sup> students.

5. The APS is undertaking an internal evaluation of its science program this year. SAC reviewed an early draft of the evaluation design and provided feedback, which included a recommendation to add metrics on student enthusiasm for science. SAC plans to follow up next year on the outcomes of this evaluation and to consider ways to more routinely monitor student progress and enthusiasm for science, especially in elementary and middle school grades.

## **Update of Previous Recommendations**

### **Past Recommendation #1:**

The APS should implement the Science Assessment portion of the K-8 Formative Assessment Initiative now to monitor the progress of students in Science.

### **Status:**

Despite strong support for this recommendation from ACI, it has not been implemented. The vendor originally contracted to supply the benchmarking product for the K-8 formative assessment initiative failed to deliver. A new vendor was secured but was unable to provide tools for the science assessment. There is currently no benchmarking of science instruction and learning.

SAC remains concerned that science instruction is not being given sufficient time or emphasis in elementary school classrooms. Our concern is validated by a decline in the SOL Science pass-rates across APS from 3<sup>rd</sup> to 5<sup>th</sup> grades in school year 2010-2011 and again in 2011-12 (Figure 1). Therefore, SAC believes it is important to develop an electronic functional assessment tool to benchmark science instruction and learning.

### **2011 – 2017 Strategic Plan Alignment:**

#### **Goal One: Ensure that every student is challenged and engaged**

- A. Present high and clear expectations
- B. Create engaging and motivating educational program choices

#### **Goal Two: Eliminate Achievement Gaps**

- A. Provide equitable educational opportunities
- B. Provide effective and dynamic classroom instruction
- C. Provide necessary and appropriate support for all students and all identified groups

**Budgetary Implications:** In our report last year, we estimated minimal costs to implement the science portion since it was included in the assessment product already contracted for reading and math. Current budgetary implications are unknown.

**ACI vote:** 19 -Yes, 0 -No, 5 -Abstaining

### **Past Recommendation #2:**

APS should develop increased integration among instructional disciplines.

### **Status:**

The Infusion of Literacy project was launched this year as a pilot to better integrate reading and science. As we report above, SAC is monitoring the use and value of this project, and will provide further recommendations next year. SAC is unaware of other efforts to integrate science with instruction in other subjects.

**2011 – 2017 Strategic Plan Alignment:**

**Goal One:** Ensure that every student is challenged and engaged

- A. Present high and clear expectations
- B. Create engaging and motivating educational program choices

**Budgetary Implications:** \$2000

**ACI vote:** 24 – Yes, 0 – No, 0 - Abstaining

**Recommendation #3:**

Middle school students should participate in inquiry-based science projects tied to the curriculum via modules developed by APS staff and teachers.

**Status:**

Science project modules have been developed for 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> grade science teachers to use for open ended student inquiry projects. The modules are focused on the Nature of Science and incorporate strands of the science SOL for these grade levels.

APS middle schools still vary in their requirement for independent science projects and participation in science fair.

**2011 – 2017 Strategic Plan Alignment:**

**Goal One:** Ensure that every student is challenged and engaged

- A. Present high and clear expectations
- B. Create engaging and motivating educational program choices

**Budgetary Implications:** \$5000

**ACI vote:** 22 – Yes, 0 – No, 2 - Abstaining

**Acknowledgement**

The Science Advisory Committee wishes to thank APS science staff: Dat Le and Matt Hubbard for their hard work in facilitating our efforts. They responded to all our questions and provided the data, advice and encouragement that made possible this report.

**Committee members:**

Marc Dantzker, Herb Fontecilla, Holly Krull, Tina Kuklenski-Miller, Aaron Manka, Louisa Marinaccio, Leslie Mitchell, Betsy Morse (ACI Liason), and Alan Tessier (Chair).

APS Staff:

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