

## **Loudoun County Public Schools Academy of Science**

### **Background**

In 2002, Loudoun County identified a need to provide a program for county residents that would specialize in science and math. In January 2005, upon hiring a director, the planning for the Academy of Science (AOS) began. In delineating a mission statement, the core of planning revolved around creating an environment where students would be challenged to leave high school with the skills needed in an increasingly “global” society where STEM skills will be important, regardless of career choices.

The mission of the AOS is to provide an academic environment where students are encouraged to develop creative scientific endeavors of their own design, while having the opportunity to pursue a rich, well-rounded high school experience. It was proposed that a student leaving the AOS will possess the following skills:

- Ask sophisticated scientific questions and conduct research and experimentation
- Read, write, and communicate at a level that is required of university students
- Integrate personal scientific and academic background into a broad (holistic) view of the world

To implement this vision, instruction in both math and science was designed around three basic principles: Integration, Inquiry, and Research.

The Loudoun County Public Schools (LCPS) AOS opened in September 2005 for grade-9 and grade 12 students. In 2006, the academy expanded to include a program of studies for grade-10 and grade-11 students. Students attend the LCPS AOS on alternating days, with the opposite day being spent at their home school. Instead of a typical four-block day, they attend for three 90-minute blocks, because one block is used for transportation to and from home schools. Students take science and math courses at the Academy and all other subjects at their home school.

### *Academic Program*

Students have a double block of science and a single block of math in all four years. The cornerstone of instruction in 9th and 10th grade is an integrated science course (students complete Earth science, chemistry, and physics in grades 9 and 10) and focus on research and experimental design.

Starting in the ninth grade, physical-science-program students are challenged to design all of their own lab experiments as teachers work as inquiry guides. No lab book is used. During the three semesters (over two years) of this course, students work with colleagues to answer, experimentally, questions relating to content. Within these three semesters, content is equivalent to, at a minimum, the content found in typical honors-level curricula in physics, chemistry, and Earth science. The key difference is the way material is presented. Intertwined in the second year of this course is “Introduction to Research”, a one credit course where students are taught basic research skills by participating in projects across science and math disciplines.

By the end of sophomore year, students design (with faculty mentoring) independent, two-year research projects to be carried out in-house. Juniors and seniors enroll in Independent Science Research in addition to AP Science and Math offerings. The research course is geared toward developing scientific habits of mind as well as integrating statistics, writing, and communication skills into scientific experimentation. In grade 11, students take a project-based biology course and their first year of Independent Research. In grade 12, students choose from one of four AP sciences and continue their research project.

In mathematics, students take a course in “AOS Analytic Geometry, Functions, and Trigonometry with Transformations” in grade 9, followed by math analysis in grade 10. In grade 11, students may choose to go directly into BC Calculus and continue to multivariable calculus or take the typical AB to BC Calculus route. Statistics and modeling are stressed at all math levels.

### **Documented Results**

The AOS does not, at this time, have longitudinal students to document undergraduate and career success. We have had four graduating classes totaling approximately 225 students. However, there are multiple anecdotal evidences of success:

- Community acceptance: AOS applications have risen from 185 in 2005 to 744 in 2012.
- College acceptance: AOS students have been accepted to all Ivy League schools including MIT and Stanford, as well as most competitive universities in the country.
- Research Internships: AOS students have excellent success securing summer internships while still in high school. Many have easily stepped into research labs at the university setting, including some labs that do not normally hire undergrads.
- Science Competitions: AOS student projects are very well received in national and international competitions. We currently have a student research collaboration with Hwa Chong Institution in Singapore and are creating a collaboration with Daegu Science High School in South Korea. AOS students have been Siemens semifinalists, Intel finalists, Virginia State Science Fair first place winners (five in 2012), ISEF Best of Category winners, and an ISEF young scientist awardee.

### **Potential Applications**

This model is adaptable on many levels:

- At the district level, schools can be set aside much like the Loudoun model, or where block scheduling is not available, this can be done on a half-day basis rather than alternating days.
- At the school level, curricula can be modified to allow students to build the skills needed to perform independent research.
- At the classroom level, the inquiry and integration can be accomplished by a long-term staff development program which incorporates aspects of the AOS curriculum into existing programs.

### **For More Information**

Contact George Wolfe, AOS Director, at [George.Wolfe@lcps.org](mailto:George.Wolfe@lcps.org); Odette Scovel, LCPS Science Supervisor, at [Odette.Scovel@lcps.org](mailto:Odette.Scovel@lcps.org); or Duke Writer, Math Instructor, at [Duke.writer@lcps.org](mailto:Duke.writer@lcps.org).