

HJR 25 (2006)
**Math, Science, and Technology Education in the Commonwealth at the
Elementary, Secondary, and Undergraduate Levels**

<http://dls.state.va.us/TechEd.htm>

2006 Meeting Summaries

Meeting #1 August 1, 2006

The first order of business of the HJR 25 Joint Subcommittee was the election of Delegate Cosgrove as Chair and Senator Devolites-Davis as Vice Chair. Delegate Cosgrove began the meeting by reviewing the events that led to the creation of the HJR 25 study. In several Joint Commission on Technology and Science (JCOTS) advisory committee meetings representatives from the private sector stressed the need for highly skilled employees in both technical and research fields. With education becoming a recurring theme in JCOTS, Delegate Cosgrove sponsored HJR 25 to study science, math, and technology education in the Commonwealth.

After the introduction to the study Delegate Cosgrove directed Staff Attorney Patrick Cushing to review the requirements and scope of the study. The staff presentation on HJR 25 can be found on the HJR 25 website hosted by the Division of Legislative Services (<http://dls.state.va.us/groups/teched/Meetings.htm>).

James Firebaugh, Office of Middle and High School Instruction, DOE, reviewed the science and math Standards of Learning (SOL) and explained that technology education is imbedded in the math SOL through the required use of a graphing calculator. Mr. Firebaugh explained that after outside review of Virginia's SOLs, Virginia ranked among the top states in science but drew criticism on the physics SOL. Senator Devolites Davis commented that her daughter took AP Physics in high school but was unprepared for a college physics class. Mr. Firebaugh responded that the AP classes and curriculum are reviewed by a college board and the SOL is only targeted for non-AP classes.

The joint subcommittee moved into a discussion on how to better incorporate technology into SOLs or possibly developing a technology SOL. This responsibility would fall under the Board of Education and the subcommittee was interested in hearing from the Board of Education on the feasibility of developing a technology SOL or increasing the use of technology in existing SOLs.

The next discussion focused primarily on students entering college in a STEM field. The general consensus was that students lack the hard math skills needed to succeed in college level physics, chemistry, and math classes. The joint subcommittee requested SCHEV to perform a preliminary survey of college students and professors to help identify specific areas of weaknesses for incoming students. Additionally, the joint

subcommittee was interested in determining if there are geographic weaknesses in math and science. Although Virginia as a state ranks fairly high in math and science education in K-12, there may be severe geographic discrepancies hidden by state-wide statistics.

The joint subcommittee next turned to a discussion of Governor's Schools in Virginia. Senator Devolites-Davis requested Mr. Firebaugh to look into statistics related to the number of incoming students, number of students rejected, and number of applicants to the various math, science, and technology Governor's Schools. Additionally, the joint subcommittee requested a presentation from the Virginia Junior Academy of Science at the next meeting.

Elizabeth Russell, Director of Career and Technical Education, DOE, presented that there are currently 88,000 students enrolled in technology related courses in the career and technology education program. Mrs. Russell reviewed several programs students may pursue, including a new course in nanotechnology. The joint subcommittee expressed an interest in learning more about Project Lead the Way.

Dr. Daniel LaVista, Executive Director, SCHEV, presented an overview of efforts to increase science, math, and technology education in the Commonwealth's universities. The joint subcommittee was interested in getting numbers on the number of STEM graduates as compared to other fields and potential salary benefits of majoring in a STEM field. A major question left unanswered was why many students enter college with intentions of majoring in a STEM field yet half of those students do not graduate with a STEM major. Another issue addressed by the joint subcommittee was the need to recruit qualified faculty and allow current faculty to devote more time to research. SCHEV is currently in the process of performing a peer review faculty pay study and will report their findings as soon as they are available. Dr. LaVista's presentation is available on the HJR 25 website.

Dr. Monty Sullivan, Virginia Community College System (VCCS), gave a brief overview on various science and technology related programs in the VCCS. Dr Sullivan's presentation is available on the HJR 25 website.

Kathleen Stansbury, President-Elect, Virginia Technology Education Association, spoke to the joint subcommittee during public comment. Mrs. Stansbury stressed the importance of integrating technology education into existing curriculum and across all subject areas. One of the tools that can be used to do this is the Standards for Technological Education. The standards were developed on a national level and have been successfully implemented by several K-12 teachers in the Commonwealth. The joint subcommittee was interested in having Mrs. Stansbury present in greater detail at the next meeting.

Meeting #2 October 10, 2006

The second meeting of the Joint Subcommittee took place on October 10, 2006 in Richmond. After the chairman called the meeting to order, the subcommittee heard

presentations from a total of five speakers and two students from the Shenandoah Valley Governor's School.

Marcia Hickey, Adjunct Instructor at the College of Integrated Science and Technology at James Madison University, informed the Joint Subcommittee about the Children's Engineering Guide.

The Guide was first published in July 2003, and the intent is for K-5th grade teachers to use it as a supplement to the core curriculum. Ms. Hickey maintains that children in kindergarten through fifth grade should study technology in order to make connections between the natural and man-made world, develop critical thinking skills, develop problem solving skills, have experiences with the true application of knowledge, gain ownership of essential knowledge, and bridge the gap between memorization of facts and the understanding of skills and processes. Technology education teaches students to determine the problem, brainstorm solutions, create solutions, evaluate the chosen solution, and finally to test the solution. Ms. Hickey's main point was that the guide helps teachers enhance the current teaching in the core Standards of Learning areas of English, math, science, history, and social science and allows children to retain content described in the Standards of Learning more successfully. She gave the subcommittee an example of a project that a third grade teacher could utilize for a math lesson. It consists of a challenge where small groups of students must brainstorm, restate the problem, build, record difficulties, and evaluate the chosen solution. After each challenge the teacher assesses each student's performance.

Ms. Hickey finished her presentation with a few statistics to demonstrate the need for further attention in the area of children's engineering. She noted that since the guide was published in 2003, only 150 teachers (.05% of the teaching population) have received school division level in-service training through Design and Technology workshops, thus professional development is an area where resources are needed. Ms. Hickey emphasized that teachers need to be trained so that they can be confident in implementing design and technology in the classroom as a means to extend and support Virginia's Standards of Learning.

Kathleen Stansbury, President of the Virginia Technology Education Association, presented the Joint Subcommittee with a preliminary report on the need for technology education in Virginia, as the Association envisions a citizenry that is technologically literate. There are six initiatives promoted by the Association as essential to achieve their vision: (1) Elementary School -- integrated learning through the elementary school curriculum; (2) Middle School -- required instruction in technology education for each student; (3) High School -- provide at least two technology education electives; (4) STEM initiative -- funding for two biennial periods to establish K-12 based technology education courses; (5) Technical Assistance -- provided by the Virginia Department of Education to the local education agencies through the services of at least three technology education program area specialists; and (6) Teacher Preparation -- establishment of pre-service and in-service education to make sure a sufficient number of teachers are available.

Ms. Stansbury emphasized that ensuring that each learner benefits from Technology Education means that it must be included within the Commonwealth's educational requirements. The Association believes that to improve and strengthen the education of all learners in Virginia's schools the study of technology, which emphasizes technological content, processes, and effects, must be included within the curriculum for every learner K- 12. Additionally, teachers must be prepared in the content and methods for developing the individual learner's technological literacy and capability.

George R. Willcox, Career Cluster Coordinator for Career and Technical Education, spoke on behalf of the Virginia Department of Education about The Standards for Technological Literacy and Project Lead the Way, a national program that partners with state agencies to provide specialized education in high school. The Standards for Technological Literacy establish requirements and benchmarks for all K-12 students, with 20 broadly stated standards that specify what every student should learn about technology, and as a result a technologically literate person understands what technology is, how it is created, how it shapes society, and is in turn shaped by society. Project Lead the Way is a not-for-profit organization offering a four year curriculum in engineering that when coupled with math and science classes introduces students to the scope, rigor and discipline of engineering and engineering technology prior to entering college. Currently 24 Virginia schools in 14 different school divisions offer Project Lead the Way courses.

Linda Cauley, Director of the Shenandoah Valley Governor's School spoke to the subcommittee about the Governor's School generally. She has been the director since it opened and emphasized that the Governor's School teachers never stop learning. The Shenandoah Governor's school provides an arts/humanities track and a math, science, and technology track with a range of options available through each. Ms. Cauley estimated that roughly half of the students that apply to attend the Governor's School are able to attend. Two current students spoke to the subcommittee about their experiences at the school. They both noted that the school is preparing them for college, gives them a chance to work independently, and allows them to take advantage of dual enrollment courses.

Dr. Daniel J. La Vista, Executive Director of the State Council of Higher Education for Virginia spoke at the first meeting in August, and returned to answer various follow-up questions the Joint Subcommittee generated at the end of that meeting.

Dr. La Vista informed the committee that SCHEV is currently working on conducting a survey of Virginia institutions in order to determine the weak skill areas in math and science of college freshman. National surveys have been conducted and have found that 85% of faculty members responded that high school graduates are either unprepared or only somewhat well prepared to pursue a college degree. Dr. La Vista also stated that 10,000 degrees are conferred every year in VA in the math, science and technology fields. The subcommittee requested more detailed information including, what percentage of those degrees are awarded to students who attended Virginia High Schools.

Additionally, Dr. La Vista noted that the median salary for all workers in 2005 was \$34,000, compared to \$56,000 among all science, math, and technology workers. With respect to professors in the STEM fields, Dr. La Vista stated that conversations with university deans and department heads acting as the hiring authority for most faculty positions reveal that teaching load is a major determinant as to whether or not a well-qualified candidate will accept a teaching offer. He also reported that other states are attracting research dollars by identifying research focus areas that attract federal research support, attracting and retaining top-notch faculty, developing new researchers from within the state, and growing the space available for faculty to conduct university research. Currently Virginia ranks 37th in the nation for research dollars expended per capita by universities, 32nd in the nation for federal research dollars per capital by universities, and 35th in the nation for state, local and institutional research dollars expended per capita by colleges and universities.

Meeting #3 October 25, 2006

The third meeting of the HJR 25 Joint Subcommittee took place at the Thomas Jefferson High School for Science and Technology (TJHSST) in Fairfax, Virginia. The joint subcommittee received a 40 minute tour of the school from TJHSST faculty and had the opportunity to walk through several classrooms and labs.

After the tour the joint subcommittee met in the TJHSST auditorium for the public portion of the meeting. Dr. Evan Glazer, Principal of TJHSST, gave a presentation to the joint subcommittee reviewing the school's history and curriculum. Following Dr. Glazer's presentation the joint subcommittee began a question and answer period with a panel of students and faculty. Below is a list of questions and answers from the joint subcommittee and student/faculty panel:

Q- Joint Subcommittee

- Why do only half of TJHSST students pursue a college major in the hard sciences?

A- Panel

- TJHSST attracts a wide variety of students who attend not just for the science and math program but for the academic rigor and reputation of the school as well.

Q- Joint Subcommittee

- At what age do students who attend TJHSST develop an interest in math and science or interest in attending the school?

A- Panel

- Students take an admissions test in eighth grade but many students begin to think about attending the school as early as sixth grade.

Q- Joint Subcommittee

- How does TJHSST develop its curriculum?

A- Panel

- TJHSST acts as a laboratory for curriculum and many schools adopt classes, labs, and lesson plans from TJHSST because they do not have the resources to develop innovative curriculum for advanced subjects.

Q- Joint Subcommittee

- How does TJHSST attract qualified teachers?

A- Panel

- TJHSST constantly receives applications but the school also performs a national search for qualified teachers. Additionally, national press coverage helps to attract top candidates to the school.

Q- Joint Subcommittee

- Private businesses were involved in the creation of TJHSST, but are they still involved?

A- Panel

- Yes, but private businesses are not as involved as they could be. The recently created fund to help support the school does receive support from private businesses.

Q- Panel

- Are there any plans to build a new facility for TJHSST?

A- Joint Subcommittee

- Yes, but construction is still many years away.

Q- Panel

- How does the joint subcommittee envision arts and humanities education integrated into a math and science curriculum?

A- Joint Subcommittee

- The arts and humanities are integral to any education and help create a well rounded and balanced society. Many members of Virginia's General Assembly have math and science backgrounds that positively contribute to their performance as an elected official.

Q- Panel

- How is science and technology education promoted throughout the state?

A- Joint Subcommittee

- Specialized science and technology education is promoted mainly through Governor's Schools but many high schools across the state have specialized curriculum in the sciences.

Q- Panel

- Are there any plans for magnet elementary schools?

A- Joint Subcommittee

- The joint subcommittee is currently studying the feasibility of magnet schools at the elementary level, as well as other programs that would generate interest in the sciences at a young age.

Q- Panel

- Does the state have any plans to build zero-energy schools?

A- Joint Subcommittee

- The construction of schools is a local responsibility so the state has very little control over school design, but there were several bills introduced during the 2006 Session that would address sustainable energy design for state buildings.

Following the question and answer segment the joint subcommittee concluded the public meeting and thanked TJHSST for their time and hospitality.