

Commerce, Justice & Science Subcommittee – STEM Education Hearings

February 3, 2010

Oliver W. Hill, Jr., Ph.D.
Professor and Chair,
Department of Psychology
Virginia State University
Petersburg, Virginia

I am the Principal Investigator on two grants from the National Science Foundation to Virginia State University which are studying innovative approaches to improve the mathematics performance of minority students in the local Petersburg Public School District. We know that mathematics background and competence are the primary gatekeepers to STEM careers.

When we started working with the Petersburg district in 2007, it was the lowest-performing school district in the state. None of its schools were accredited. In 2009, all but two of the schools were fully accredited, and those two missed it by a few points. We expect all to be accredited this year. On standardized mathematical performance, the two schools we worked directly with had 127% and 74% increases in scores, respectively.

Our project wasn't the only thing at work here. A new, dynamic superintendent, Dr. James Victory, was hired during the second project year, for example. But our research indicated the dynamic effect that our interventions were having on the students.

The project involved training teachers in the innovative pedagogy of the Algebra Project, and organizing the community around support for the schools. The Algebra Project curriculum was developed by Dr. Robert Moses, who was the recipient of a MacArthur "genius" award. The pedagogy helps students connect abstract mathematical principles to their everyday language and experience. The Algebra Project approach also relies heavily on community involvement. With their help, we are in the process of developing a "K-16" model with Petersburg and the university, with the approach that we need to make contact with students early in their educational experience, and groom them toward STEM programs. This relationship involves programs like dual enrollment courses, providing math and science grad students as teachers, providing college student tutors, and providing

services to students through the involvement of departments like psychology, sociology and nursing.

One of the most innovative aspects of our project is testing the impact of cognitive training on the mathematics performance of students. Students coming from low SES backgrounds (and many with middle class backgrounds) often lack the capacity for abstract thinking required for success in higher-level mathematics and science courses, and this is a major barrier to pursuing a STEM-related career. These deficiencies are usually addressed through content-based remediation and tutoring programs, but there have been numerous studies documenting the failure of these types of content-based interventions to have meaningful impacts on basic skill development or educational achievement, particularly among minority students.

The approach of direct cognitive *training* represents a unique method of developing the underlying thinking skills needed for success in STEM. This approach is not the usual teaching of “critical thinking” skills, which represent fairly high-level cognitive processing, but rather it builds the basic architecture of cognition by training basic cognitive skills such as processing speed, attention, and working memory. At one time it was thought that these kinds of skills were set by the time one reached adolescence, but we now know that these skills are malleable, even into adulthood.

We have been using the procedures developed by an educational firm called LearningRx, which runs cognitive learning centers around the country. The data collected in these centers over the last few years has indicated tremendous gains of three to four grade levels in reading and other cognitive skills after only 15 weeks of fairly intense one-on-one interventions. We are testing whether meaningful results can be obtained using an on-line version of the program that can be administered in groups, which would be more practical in a school setting. Our initial data looks very promising.

This approach has the potential to revolutionize education in general, and STEM education in particular. We think this addresses one of the primary developmental problems that blocks success in mathematics and science classes – weak cognitive skills.

I teach at Virginia State University (VSU), which is an HBCU, and I want to speak for a moment about the role that HBCU’s can play in addressing the underrepresentation of minorities in STEM careers. HBCU’s have the students

who could fill those majors – VSU loses literally hundreds of potential STEM majors each year because of difficulties with math. We need to focus more research dollars to investigators at HBCU's to develop promising interventions to attract and hold minority students in STEM majors. Initiatives targeted to HBCU's at funding agencies like NSF and NIH need to receive greater support.

Finally, the crisis in STEM education is but one facet of the larger crisis in education that we face as a nation. We know what quality education looks like – we can look at the curriculum of the best schools in any city, such as the Maggie Walker Governor's School in Richmond, or the Appomattox Governor's School in Petersburg and see the rich programs they provide. Yet for too long we as a nation have said it was okay for millions of our students in inner cities and poor rural communities to receive substandard education with watered down curricula and poor instruction. This is human capital we can't afford to squander that could represent untold resources for our country.

We need to take the position that quality education is a civil right for all children in this country, and we need to develop the political will to make that a reality.

I'll be happy to supply more details on any aspects of the interventions I mentioned during the period of questioning.

Thank you.