Florida TaxWatch

Ideas in Action

February 2010

Ideas in Action is a public forum to present discussion in vital issues affecting the economy, public policy, and concerns that touch the lives of many Floridians. The opinions expressed in this Ideas in Action are those of the authors and do not necessarily reflect those held by the members, staff, or the distinguished Board of Trustees of Florida TaxWatch.

106 N. Bronough Street (32301-7723) ♦ P.O. Box 10209 (32302-2209) ♦ Tallahassee, FL ♦ Phone: 850/222-5052 ♦ Fax: 850/222-7476

PREPARING FLORIDA'S STUDENTS TO CLOSE THE TALENT GAP FOR AN INNOVATION ECONOMY

by Paul D. Cottle, Ph.D

Paul Cottle is a Professor of Experimental Nuclear Physics and Undergraduate director in the Department of Physics at Florida State University. He has been with the Florida State Physics Department since 1986 after earning his Ph.D. at Yale University. He is presently Chair Elect of the Southeastern Section of the American Physical Society, which awarded him the George B. Pegram Medal for Excellence in Physics Teaching in 2002. He may be reached at cottle@phy.fsu.edu.

Florida's business community has now spoken: The Florida Council of 100 and the Florida Chamber of Commerce have said unmistakably in a report titled "Closing the Talent Gap" that, if Florida is going to rebuild its economy on a solid foundation of innovation, the state will have to make dramatic improvements in math and science education. The report's authors point out that Florida is presently 40th in the nation in the education of scientists and engineers per 100,000 of population. The report also says that by 2015 – only five short years away – Florida will need at least 100,000 more STEM (science, technology, engineering and mathematics) professionals than it will have educated.

While Florida's universities are the "finishing schools" for science and engineering professionals, their success in educating students for these fields depends critically on the efforts of the state's high schools in providing strong math and science preparation. A study published in the journal Science in 2007 [Philip M. Sadler and Robert H. Tai, Science, Vol. 317, p. 457 (2007)] demonstrated that students' success in college science classes depends in part on their high school science and math classes. For example, a student is more likely to succeed in a college physics class – which is required for every science, engineering and math major - if they have taken a high school physics class. Taking calculus in high school is also correlated with success in college science classes.

In fact, a study published in 2007 by a group from the University of South Florida [Will Tyson, Reginald Lee, Kathryn M. Borman, and Mary Ann Hanson, Journal of Education for Students Placed at Risk, Vol. 12, No. 3, p. 243–270 (2007)] demonstrates that high school physics has a direct connection to the attainment of bachelors' degrees in STEM (Science, Technology, Engineering and Mathematics) fields.

The USF group took advantage of Florida's state-of-the-art educational databases (the Florida Education and Training Placement Information Program – FETPIP - and the Florida Department of Education student data warehouse) to link students' high school transcripts to their postsecondary outcomes.

They concluded that in high school, "enrollment and attainment in physics and calculus is particularly important for all students with respect to obtaining a STEM degree down the road." The USF authors were surprised and encouraged to learn that "minority students who are prepared for STEM degree attainment by virtue of taking high-level science and

mathematics courses, particularly calculus, chemistry, and physics at the highest levels, are more likely to persist through STEM coursework in college than their white counterparts and obtain a STEM degree."

However, it is clear that Florida's high schools are not doing well in science. In 2009, Florida's high school graduates ranked 49th in the nation on the science section of the American College Test (ACT). In 2008, the state was 47th in the nation in passing rate on Advanced Placement examinations in science. Only 16% of Florida's 2008 high school graduates took a physics class – about half the national rate determined by the American Institute of Physics in 2005. This lack of success in high school science has been noticed outside the state. A report released by Batelle and the Biotechnology Industry Organization listed Florida among the weakest ten states in preparing high school students for biotechnology fields, along with Arkansas, Georgia, Louisiana, Mississippi, Nevada, New Mexico, Oklahoma, Texas and West Virginia.

Last summer, ninety science professors from thirteen colleges and universities in Florida assembled a "white paper" on high school science in the state. They offered a concrete proposal for graduation and assessment policies for science in Florida's public high schools. Incidentally, major revisions of graduation and assessment policies – including those in science – will be considered by the Florida Legislature this year. The science professors said that these steps should be taken at the high school level to promote scientific literacy among all students and to better prepare students who have interests in science and engineering careers for the rigorous undergraduate programs in these fields:

• **Require three science courses, including at least one each in life science, physical science and Earth/space science, for high school graduation.** Florida presently requires three science courses for graduation but does not specify the fields in which these courses should be taken. A student should have basic knowledge in all three science fields to prepare for responsible citizenship in our technological society. While the Florida Department of Education (FDOE) maintains a long list of science courses that the state's high schools can choose to offer, the science faculty white paper selected a subset of only 33 of these courses that they believed should count toward graduation.

• **Require four science courses, including at least one each in biology, chemistry, Earth/space science and physics, for Bright Futures eligibility.** Our best and brightest students – our Bright Futures recipients – should all be prepared for leadership roles in our technological society. In addition, they should all have the basic tools required to pursue undergraduate programs in science and engineering so that they have the fewest possible obstacles to choosing a career in one of these areas. It should be noted that this proposal is budget-friendly – it will likely limit the growth of the Bright Futures program. A four science course requirement for Bright Futures eligibility is not onerous – our neighboring states of Alabama, Georgia and Mississippi require four science courses for all of their high school graduates.

• **Implement end-of-course tests in each science area, including biology, chemistry, Earth/space science and physics, by 2013.** End-of-course tests provide quality control for high school science courses in two ways. First, they give high school and district administrators information about the achievement of students in a course which can be used for strategic decisions, including teacher evaluations. Second, they provide some assurance to college instructors that students have been exposed to a standard syllabus of topics in their high school science courses. My colleagues and I have found that it is quite common for high school science teachers to delete topics from their courses.

The science faculty who authored the white paper also recognized that the end-of-course tests would require a significant investment to implement (it was reported by FDOE this year that each test costs $1.5 million per year), and so they recommended considering the use of commercially available exams like the SAT II achievement tests or partnering with other states like New York that have existing end-of-course tests to curb costs. In fact, the FDOE is exploring the possibility of participating in a consortium that would jointly

develop and implement end-of-course tests. The US Department of Education has set aside a $350 million fund to assist states in such efforts to develop joint assessments.

The science faculty also highlighted the importance of providing a strong professional development program for high school science teachers and cited the importance of the "Reading First" professional development program in improving student achievement in reading in Florida during the last decade. The white paper recommended a very aggressive program that would provide $3,000 per high school science teacher per year for research-based professional development of the highest quality. With approximately 10,000 secondary science teachers in Florida, such a program would require $30 million per year. At present, math and science professional development for all Florida teachers from kindergarten to high school is being provided through the federal PROMISE grant, which has a clearly inadequate budget of $8 million this year. With the "brutal" (to borrow the word used by Florida Education Commissioner Eric Smith) state budget outlook for the next two fiscal years, it seems unlikely that an adequate professional development program for high school science teachers can be provided in the short term. However, the state should seriously consider a well-funded program for high school science teachers once the state's fiscal situation begins to recover. Such an investment would provide a meaningful compact for excellence with the state's science teachers.

While the professional development of in-service high school science teachers is an important part of an improvement plan for Florida, the recruiting and training of new science teachers is just as important. New science teachers come to Florida's high schools through two routes – via the science departments and education schools at the state's colleges and universities, and through "alternative certification" programs for career-changing professionals. The Florida Senate Committee on PreK-12 Education expressed concern about the supply of science teachers in an Interim Report it issued in October 2009 titled "Review the Effect of State High School Graduation Requirements on Student Preparation for Postsecondary Education and the Workforce." While saying that the "state should aggressively recruit STEM educators from postsecondary institutions and the high-tech business sector," the report also called for a moratorium on "more rigorous mathematics and science high school graduation requirements" until the "education and business communities are certain that appropriately trained educators are available to teach these courses."

It is clear from the concerns expressed in the Senate report that the FDOE should take a careful look at the supply of highly qualified teachers for the individual science subjects in Florida's high schools. However, the American Institute of Physics has concluded in its 2009 High School Physics Survey (to be released in total in February) that only 4% of Florida public high school students graduate from a school that does not offer physics on a regular basis. Physics courses, at least, are available to nearly every Florida public high school student, and the grievously low participation rate in these courses quoted above is a matter of the choices of students and the advice (or lack thereof) from counselors, teachers, parents and peers.

Nevertheless, the call in the Senate Interim Report to identify "barriers to recruiting" STEM educators from the colleges and high-tech business sector is important. It is certainly possible that salaries paid to starting teachers in Florida (and elsewhere) provide one such barrier, at least in some science fields. In Fall 2009, the National Association of Colleges and Employers issued its annual report on starting salary offers by campus recruiters nationwide during the 2008-2009 academic year. The middle 50% of salary offers by campus recruiters to new bachelor's degree recipients in physics was $40,000-$64,000, while starting salary offers to chemical, electrical and mechanical engineers were even higher (chemical engineering led the way with a middle 50% range of $60,000-$70,000). It certainly seems likely that teaching salaries, for which the salary survey reported a national middle 50% range of $32,000-$41,000, provide an obstacle for recruiting physics teachers.

In contrast, the salary survey indicated a middle 50% salary range of $26,000-$39,000 for new bachelor's degree recipients in biology and the life sciences. From this we can conclude that salaries are probably not a barrier for recruiting biology teachers. The middle 50% ranges for new bachelor's degree recipients in chemistry ($31,000-$47,000) and mathematics ($37,000-$60,000) lie between the extremes represented by biology and physics.

Florida's application to the federal Race to the Top program – a competitive grant program being conducted by the US Department of Education with a $4.3 billion prize pool – includes the mention of a differential pay program for math and science teachers. The salary data suggest that it might be prudent to focus differential pay incentives on physics, math and chemistry teachers.

Furthermore, it also seems prudent to focus teacher recruiting and education efforts at the state's universities on physics, math and chemistry, given the salary disincentives that would exist even with a substantial differential pay program. The PhysTEC program at Florida International University is already doing this, with the efforts of a physics professor, an education professor and a "mentor" high school physics teacher (on leave from the public schools for a year) devoted to teacher education and some external funding provided by the National Science Foundation. Alternative certification programs that allow mid- or late-career professionals from the business sector to move into science classrooms have been an important source of science teaching talent for the state's public schools. Such programs are by definition opportunistic – they recruit experienced technology professionals who for one reason or another find teaching the most attractive career option available at a particular point in their lives. While the imminent demise of the space shuttle program and the resulting layoffs of 7,000 professionals at Kennedy Space Center are tragic, these events may provide an opportunity for recruiting a substantial number of chemistry, math and physics teachers via alternative certification programs. Such a possibility should be considered alongside other recovery efforts being considered for this group by Florida's leaders.

During the 2009 session of the Florida Legislature, both House and Senate considered measures that would have focused the science teaching programs of Florida's high schools on biology, to the exclusion of other science subjects. Given the importance of chemistry, physics and Earth/space science to the education of Florida's high school students, the passage of these bills into law would have been a serious policy mistake. Both houses of the legislature appear poised to take up this subject again, but this year there are hopeful signs that legislators recognize the importance of a comprehensive approach to high school science. It is critical to the development of an innovation economy in Florida that the legislature follows through.

Key References

"Closing the Talent Gap: A Business Perspective," Florida Council of 100 and the Florida Chamber of Commerce, January 2010, available at http://www.fc100.org.

Florida Senate Interim Report 2010-112, "Review the Effect of State High School Graduation Requirements on Student Preparation for Postsecondary Education and the Workforce", October 2009, http://www.flsenate.gov/data/Publications/2010/Senate/reports/interim_reports/pdf/2010-112ed.pdf.

National Academy of Education, "Science and Mathematics Education Policy White Paper," November 2009, http://www.naeducation.org/Science_and_Mathematics_Education_White_Paper.pdf.

Philip M. Sadler and Robert H. Tai, Science, Vol. 317, p. 457 (2007).
"Physics Majors Pull in High Starting Salaries," American Physical Society News, November 2009, http://www.aps.org/publications/apsnews/200911/physicsmajors.cfm.

Will Tyson, Reginald Lee, Kathryn M. Borman, and Mary Ann Hanson, Journal of Education for Students Placed at Risk, Vol. 12, No. 3, p. 243–270 (2007).

For a copy of this *Ideas in Action*, please call:
(850) 222-5052
OR
Write to Florida TaxWatch at: P.O. Box 10209
Tallahassee, FL 32302
OR
Access and download the report at:
www.FloridaTaxWatch.org where this *ideas in Action* was initially released before being printed in hardcopy format

NON-PROFIT ORG.

U.S. POSTAGE
PAID

TALLAHASSEE, FL
Permit No. 409