

## Appendix 1

### Presidential Task Force on STEM Workforce University System of Maryland August 1, 2008<sup>1</sup>

**Context:** Maryland is emerging as a powerhouse in the knowledge-based economy. With a high concentration of government labs, a growing technology based private sector, and a strong system of higher education, Maryland already ranks first in the nation in R&D expenditures per capita and second only to California in total R&D expenditures. The state is also ranked 2<sup>nd</sup> to Massachusetts in the recent Milken Institute's index of state research and technology capacity. In large measure, this success is driven by the education level of Maryland's workforce (percent of the population with bachelor's, Masters and PhD degrees), which ranks in the top five nationally.

Despite these glowing statistics, there are challenges on the horizon. There will be a large number of retirements in the coming decade as Maryland's highly educated 'baby boomer' population reaches retirement age. There is also a large demographic shift under way within the college age population. Under represented minorities, which have traditionally had lower college going rates, is the fastest growing segment of this population. Moreover, there is a shortage of highly qualified teachers in math and science in the K-12 sector, which – unaddressed – could have devastating effects on the development of the future workforce in STEM (science, mathematics, technology, and engineering) fields.

The USM has identified Maryland's competitiveness, including the development of a world class STEM workforce, as one of three overarching system wide priorities. In addition, Governor O'Malley has appointed a STEM Commission to address Maryland's workforce and R&D needs in the STEM areas. This Commission is co-chaired by the Chancellor and has strong representation from USM institutions.

**Charge:** The Presidential Task Force on the STEM Workforce is asked to both develop USM workforce development strategies for the USM's competitiveness initiative and to provide advice and support to the Chancellor and other USM representatives for their work on the Governor's Commission.

More specifically, the Presidential Task Force on the STEM Workforce is charged to study and report on the following issues:

- Projected state wide workforce shortages in the STEM fields, with special attention to the K-12 shortfall of highly qualified STEM teachers
- Targets for USM institutions to achieve in order to address STEM workforce shortages
- Strategies to achieve these targets
- Resources required to support the workforce development strategies
- Advice to the Governor's Stem Commission
- Actions and policies at the state level that would support the creation of a strong and vital STEM workforce in Maryland

In responding to these issues, the Task Force should consider these questions:

- Do we have appropriate programs in place to achieve the recommended STEM graduation targets?
- Do we have appropriate programs in place to recruit and prepare an adequate number of STEM teachers?

---

<sup>1</sup> A second Presidential Task Force has been appointed to address competitiveness issues from a translational research and economic development perspective.

- Do we have appropriate financial incentives to achieve recommended enrollment targets?
- Do we have appropriate financial incentives to recruit STEM majors into STEM careers?
- Do we have adequate faculty in the right places to deliver the programs necessary to meet our enrollment and graduation targets?

**Task Force Composition and Report:** The Task Force will be chaired by Bob Caret, president Towson University, with membership drawn from the presidents and senior officers at USM institutions. The Task Force is asked to complete its report for the USM competitiveness initiative by the end of this calendar year. A status report should be developed by mid-October that will inform the USM's FY 2010 budget request. The Task Force is asked to be "on call" to support the Chancellor's efforts with the STEM Commission.

**Appendix 2:****STEM Presidential Task Force****Dr. George Acquah**

Dean, School of Arts and Sciences  
Bowie State University  
14000 Jericho Park Road  
Bowie, MD 20715  
(301)-860-3610  
FAX (301) 860-3325  
[gacquaah@bowiestate.edu](mailto:gacquaah@bowiestate.edu)

**Dr. Robert Caret (Chair)**

President  
Towson University  
8000 York Road  
Towson, MD 21252  
(410) 704-2356  
FAX (410) 704-3488  
[rcaret@towson.edu](mailto:rcaret@towson.edu)

**Dr. Scott Dantley**

Associate Provost  
Coppin State University  
2500 West North Avenue  
Baltimore, MD 21216  
(410) 951-3828  
FAX: (410) 951-2644  
[sdantley@coppin.edu](mailto:sdantley@coppin.edu)

**Dr. Irwin Goldstein**

Senior Vice Chancellor  
for Academic Affairs  
University System of Maryland  
3300 Metzert Road  
Adelphi, MD 20783  
(301) 445-1992  
FAX (301) 445-1914  
[irv@usmd.edu](mailto:irv@usmd.edu)

**Dr. Joseph Hoffman**

Dean, College of Liberal Arts &  
Sciences  
Frostburg State University  
101 Braddock Road  
241 Compton Science Center  
Frostburg, MD 21532-1099  
301-687-4120  
FAX (301) 687-3084  
[jhoffman@frostburg.edu](mailto:jhoffman@frostburg.edu)

**Dr. Gregory Von Lehmen**

Senior Vice Provost  
University of Maryland University  
College  
3501 University Boulevard East  
Adelphi, MD 20783  
(240) 582-2887  
FAX (240)582 2994  
[gvlehmen@umuc.edu](mailto:gvlehmen@umuc.edu)

**Dr. John Martello**

Vice Provost  
Continuing & Professional Studies  
University of Maryland, Baltimore  
County  
1000 Hilltop Circle, ACIV-B 460  
Baltimore, MD 21250  
(410) 455-3832  
FAX (410) 455-1344  
[martello@umbc.edu](mailto:martello@umbc.edu)

**Dr. Malinda B. Orlin**

Vice President Academic Affairs  
University of Maryland, Baltimore  
520 West Lombard Street  
Baltimore, MD 21201  
(410) 706 1850  
FAX (410) 706 0234  
[mborlin@umaryland.edu](mailto:mborlin@umaryland.edu)

**Dr. Dennis Pataniczek**

Dean, Seidel School of Education &  
Professional Studies  
Salisbury University  
1101 Camden Ave  
Salisbury, MD 21801-6837  
(410)-543-6335  
FAX (410) 548-2593  
[dapataniczek@salisbury.edu](mailto:dapataniczek@salisbury.edu)

**Dr. Candice Rettie**

Vice President  
University of Maryland Biotechnology  
Institute  
701 East Pratt Street, Suite 200  
Baltimore, MD 21202  
(410) 385-6311  
(410) 385-6367  
[rettie@umbi.umd.edu](mailto:rettie@umbi.umd.edu)

**Dr. Mahlon Straszheim**

Professor of Economics  
University of Maryland, College  
Park  
3139 Tydings Hall  
College Park, MD 20742  
(301) 405-3502  
FAX (301) 405-3542  
[straszhe@econ.umd.edu](mailto:straszhe@econ.umd.edu)

**Dr. Larry Thomas**

Dean, College of Liberal Arts  
University of Baltimore  
1420 N. Charles Street  
Baltimore, MD 21201  
(410) 837-5361  
FAX (410) 837-5336  
[lthomas@ubalt.edu](mailto:lthomas@ubalt.edu)

**Mr. Joseph Vivona**

Vice Chancellor  
Administration & Finance  
University System of Maryland  
3300 Metzert Road  
Adelphi, MD 20783  
(301) 445-1923  
FAX (301) 445-2762  
[jvivona@usmd.edu](mailto:jvivona@usmd.edu)

**Dr. Charles Williams**

Vice President, Academic Affairs  
University of Maryland Eastern  
Shore  
11868 Academic Oval  
JT Williams Administration  
Building, 2104  
Princess Anne, MD 21853  
(410) 651-6508  
FAX (410) 651-6085  
[cwilliams@umes.edu](mailto:cwilliams@umes.edu)

**Staff:**

Dr. Kate Denniston, TU  
Jennifer Gajewski, TU  
Ben Passmore, USM  
Nancy Shapiro, USM  
Anthony Foster, USM

### **Appendix 3:**

#### **List of Meetings:**

September 2, 2008  
September 10, 2008  
September 24, 2008  
October 8, 2008  
October 29, 2008  
November 17, 2008  
December 4, 2008  
December 16, 2008

## Appendix 4:

### *USM STEM Teacher Initiative “STEM-Teach”*

**Summary:** USM proposes to develop a system-wide program to recruit more science and mathematics majors into teaching by establishing new programs within colleges of mathematics, engineering and sciences in collaboration with colleges of education, modeled, in part, on the successful programs at the University of Texas at Austin (UTeach). Simultaneously, USM will develop extensive professional development programs (including online masters programs) for current science and mathematics teachers aimed at enriching content knowledge and enhancing pedagogical content knowledge.

The initiative will be developed to include several pathways to educate and produce triple the number of new science, technology, engineering and math majors. It will include the following two types of programs, which will be discussed further below:

- I.     **PRODUCING NEW STEM TEACHERS**  
    Part 1: Recruiting New Highly Qualified STEM Teachers in Maryland  
    Part 2: Certification and Master’s Programs for Degree Holders
  
- II.    **SUPPORTING AND ENHANCING THE CURRENT STEM TEACHER WORK FORCE IN MARYLAND**

The USM Initiative addresses the state’s high priority need to increase the number of science, technology, engineering, and mathematics majors graduating from Maryland universities and colleges. The USM will work with the Maryland State Department of Education, through this Initiative, to develop high quality standards for alternative certification. At the same time that this USM Board of Regents initiative is moving forward, a statewide blue-ribbon advisory committee has developed a proposal for a comprehensive state-wide STEM Institute, located at USM, to include innovative STEM academies as well as professional development centers in multiple school districts. USM is the largest producer of teachers in the state, and the USM Initiative is a critical program to provide STEM teachers. The USM Initiative would provide the support necessary for its institutions to develop the required programs. The USM STEM Initiative would also permit USM to be a strong partner in any state-wide effort to develop effective programs at multiple levels.

Funding for the program includes support for redesign of courses and curriculum, support for mentored field experiences and internships, and funds for scholarships and recruiting students into the program, as well as administrative support at the University System that would include research and program evaluation. The initial funding request is \$1.5 million in the first year of the project for planning and initial pilot implementation, with increases to \$3 million in year 2, and steady state funding of \$5 million annually to support the fully implemented program in year 3.

**Introduction:** Like many other states, Maryland is losing students from technology-related career paths in middle school and high school because of a lack of qualified, inspiring mathematics and science teachers. The National Academies' panel review of the current trends in education, economics, and science and technology conveys a sense of urgency and challenges states to respond with strategic planning around the first of the recommendations: "Increase America's talent pool by vastly improving K-12 science and mathematics education." (*Gathering Storm*, p.5, 2006)

## **I. PRODUCING NEW STEM TEACHERS**

### **Part 1: Recruiting New Highly Qualified STEM Teachers in Maryland**

As part of the solution to this problem, USM proposes to replicate a successful program that was developed in Texas to recruit more science and mathematics majors into teaching. The program, UTeach, developed at the University of Texas at Austin, was initiated in 1997; since then, UT has doubled the number of math majors and increased by 5-6 times the number of science majors being certified. They also have data that indicates that the 75% of the teachers who graduated in 2001 are still teaching.

Building on the successful UTeach model, the key elements of a USM STEM Teacher Initiative (*STEM-Teach*) to recruit and educate new STEM teachers include the following:

1. New pedagogy classes to replace the traditional courses focused on how to teach math and science, intermingled in the curriculum with discipline courses.
2. Adherence to national and state guidelines for math and science education.
3. Employment of outstanding, experienced high school and middle school teachers as instructors, advisors and field supervisors along with regular Science and Education faculty.
4. Inclusion of field experiences in the pedagogy courses at every level.
5. Providing monetary and tuition incentives to try the program.
6. Internships for students performing jobs that are relevant to the teaching profession.
7. Scholarships based on good performance in the program, especially for upper-division students.
8. Substantial support system, including assistance with lesson plans, curriculum and classroom management.

### **Part 2: Certification programs for degree holders.**

These programs can be designed either as post-baccalaureate certificate programs or master's certification programs. In this way, the project can expand to develop a one-year post-baccalaureate teacher certificate and a master's degree in Science and Mathematics Education. These options are of particular importance in meeting the needs

of individuals who have completed their baccalaureate degrees in STEM areas; the programs would be developed to meet the needs of the recent graduate as well as the “career changer.”

## **II. SUPPORTING AND ENHANCING THE CURRENT STEM TEACHER WORKFORCE IN MARYLAND**

A second important locus of activity for the USM STEM-Teach Initiative is an investment in the current workforce. According to the recent report, *Rising Above the Gathering Storm*,

- In 1999, 68% of US 8th grade students received instruction from a mathematics teacher who did not hold a degree or certification in mathematics.
- In 2000, 93% of students in grades 5-9 were taught physical science by a teacher lacking a major or certification in the physical sciences (chemistry, geology, general science, or physics).

Current research strongly demonstrates that teachers’ content knowledge has a direct impact on student learning outcomes. Professional development is key to supporting effective science instruction. USM will develop programs that create

- Opportunities for teachers to deepen their knowledge of science and mathematics content of the K-12 curriculum.
- Opportunities for special attention to elementary and middle school mathematics content knowledge through targeted professional development and innovative masters programs.
- Opportunities for teachers to learn how student learn science and mathematics and how to teach it.
- Opportunities for teachers to learn how to assess children’s developing ideas over time.
- Opportunities to learn how to teach science to diverse student populations.

Best practices in professional development parallel new teacher support programs in many ways, which allows USM to leverage the resources allocated to this project. In addition to some of the elements listed above, the initiative will partner with local school systems to develop:

- *Teaching mentor/ fellow programs* for the best teachers of science, mathematics, and technology to come for a summer, a semester or a year to further develop their skills. Activities will expand their role as expert teacher mentors and enhance their capacity to serve as teacher leaders supporting mathematics, science, and technology curriculum development and teacher enrichment in their schools.
- *Experiences in authentic science research labs for K-12 STEM teachers* to enrich the content knowledge of teachers and assist them in deepening their understanding of research and the scientific method.

- *Teacher resource and technology centers* with a library of printed and electronically accessible materials as well as sample lesson plans, materials, and information for using technology in classrooms for the teaching of science and mathematics.

### **III: PROJECT GOALS AND BUDGET**

#### **Goals:**

*Increase the number and diversity of students seeking teacher certification and develop these students into teacher leaders in their respective STEM disciplines.*

Specifically, over a five-year period the USM intends to (1) triple the number of science and mathematics students in the pipeline to become secondary science and math teachers and (2) triple the number of students graduating from USM institutions with secondary teacher certification in science and/or mathematics.

According to the most recent data collected by *MSDE Staffing Report (2006)*, USM institutions produced a total of 45 secondary mathematics teachers and 46 science teachers from undergraduate teacher education programs in 2004-2005.

#### **Budget:**

The budget for the USM STEM program to recruit more science and mathematics majors into teaching and to develop extensive professional development programs (including online masters programs) for current science and mathematics teachers can be described in three categories of expenses:

- expenses related to students (including student recruitment and support);
- expenses related to faculty (including hiring new faculty into the new programs, and supporting the development of professional development programs and courses); and
- program administration and support (including coordination at both the campus and system levels, and funding for evaluation, assessment and accountability).

Student-related expenses include tuition reimbursement for a cohort of 30 students per semester taking one one-credit course per semester at \$400 per course, and, in year two, a second cohort of 30 students per semester taking one one-credit course. In addition, in order to increase retention and reduce dropout rates from the program, the budget includes funding for advising, summer internship opportunities, and other student activities.

Faculty related expenses include two new faculty lines for master-teachers who will design and develop the new courses (one science and one math), and faculty support for those STEM faculty members who will be developing the new professional development programs, including online programs for current science and mathematics teachers. In



addition, the budget includes funding for mentor teachers in the high schools and middle schools who accept teacher candidates into their classes for field experiences

Administrative expenses include funding for program directors and staff support on the campuses whose main responsibilities will be recruitment of students into the program, program management, and accountability. At the University System, program administration will include staff support for overall program management across multiple campuses.

## **CERTIFICATION/MASTER'S PROGRAMS**

### **Student related expenses**

Tuition Reimbursement	\$24,000	\$48,000
Student Advising & Instructional Tech. Support	150,000	350,000
Internship Program	200,000	400,000
Student Activities	30,000	75,000

### **Faculty related expenses**

Faculty Compensation	600,000	1,200,000
IT Support & Web Design	35,000	70,000
Course Equipment and Activities	46,000	100,000
Mentor Teachers	150,000	300,000

**CERTIFICATION/MASTERS PROGRAM EXPENSES**                 **\$1,235,000**                 **\$2,543,000**

### **Administration**

Institution Directors - Faculty/staff	130,000	272,000
Materials and Supplies	35,000	65,000
USM Coordinator/staff	100,000	120,000

**ADMINISTRATIVE EXPENSES**   **\$265,000**                 **\$457,000**

**Total Expenses**   **\$1,500,000**                 **\$3,000,000**

**State Appropriation**   **\$1,500,000**                 **\$3,000,000**

