Strengthening the STEM Education & Workforce Pipeline: Insights from the BHEF U.S. STEM Education Model Led to the STEM Higher Education and Workforce Project

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BHEF’s STEM Initiative

Seeks to answer these questions:

• Could we double the number of college graduates in the STEM disciplines in 10 years?

• What would be the highest leverage strategies to achieve this goal?
The BHEF U.S. STEM Education Model

• Developed by Raytheon and donated to BHEF in 2009
  – Now managed by BHEF-Ohio State-Raytheon partnership
• Available through www.bhef.com Web version at:
  http://forio.com/simulate/bhef/u-s-stem-education-model/overview/
Doubling the Number: Insights from the Model

• Neither K-12 strategies nor higher education strategies alone are likely to achieve this aim

• **STEM-capable K-12 teachers are vital** to increasing the pool of likely STEM majors

• **Interest in STEM and proficiency in math are key and independent determinants** of choosing STEM major/career

• **Strengthening undergraduate education** yields an early and significant return on investment

• **Strategies and programs** have been proven to increase STEM persistence and deepen STEM learning
New ACT Longitudinal Data Sets

• National Data set tracks STEM interest and proficiency from 8th grade to into college majors by race, ethnicity, income and other characteristics
• Permits data analysis and modeling of subgroups
• Permits modeling of numerous policy alternatives
• BHEF has dozens of state data sets for modeling state policy
Low Levels of Interest in STEM and Proficiency in Math Among College-bound 12th Graders Results in Relatively Few Students Likely to Major in STEM or take STEM Courses

SOURCE: ACT. (2008). BHEF analysis of the EPAS Data provided by ACT.
STEM Degrees for Community College Students

2001 Degree Attainment and Persistence Among Students First Enrolled at Public 2-Year Institutions for STEM Entrants 1995-96

- **22%** Attained a bachelor's degree in a STEM field
- **7%** Attained a degree or certificate in STEM
- **14%** No STEM degree or certificate but were still enrolled in a STEM field
- **20%** No STEM degree or certificate and changed to a non-STEM field
- **37%** Left post-secondary education without a degree or certificate

Challenges to Strengthening STEM Undergraduate and Graduate Education

• Fewer than half of students who begin in STEM disciplines stay the course; most who change transfer to another major after first year; out migration most severe for women and minorities

• Minority degree numbers dropping or failing to keep pace, even among Asian-American students

• Freshmen intending to major in S&E and engineering is flat, but decreasing among Blacks & Hispanics (2004-2008)**

• Broken pathway from community colleges to 4-year colleges in STEM—less than 10% of transfers are STEM majors in some systems; 7.3% graduate

• Some bright spots, however – aerospace and mechanical engineering degrees increased and Professional Science/Engineering Masters being adopted by corporations, e.g. UMBC Cyber Security Masters

Source: NSB Science & Engineering Indicators, 2010 Table 2-13. U.S & Permanent Residents
** Source: NSB Table 2-6/HERI Survey of American Freshman 2009
Undergraduate STEM Attrition by Major

*includes Chemistry, Physics, Earth and Planetary Sciences

And only about half of STEM college graduates choose to work in STEM careers upon graduation.

- 100: All students who enter college and obtain a Bachelor’s degree.
- 19: Students who graduate with a Bachelor’s degree in a STEM major.
- 10: STEM Bachelor’s degree-holders working in STEM (immediately after college).
- 8: STEM Bachelor’s degree-holders working in STEM (after 10 years).

STEM Higher Education and Workforce Project: Focus on Persistence and Deepening Learning

- Led by Walt Havenstein (CEO, SAIC) and Mark Wrighton (Chancellor, Wash U)
- Data analysis and modeling;
- Research on institutional co-curricular programs, course improvement, student persistence and learning;
- Examination of external programs e.g., early internships and research that introduce freshmen and sophomores to STEM careers; and,
- An exploration of STEM skills that are essential to industry/gov.
- Pilot projects with BHEF members to improve STEM undergraduate and graduate education (MD, OH, WI)
UMD System Pilot Project to Boost STEM Grads by 40%

- Led by System Chancellor Brit Kirwan, UMD System will:
  - Conduct migration study for STEM disciplines
  - Address first-year attrition by adopting co-curricular program, e.g., freshman research program, cohort program
  - Restructure first-year STEM courses (based on Carl Wieman’s principles)
  - Collaborate with business, (Raytheon, Northrop, SAIC, Battelle), and Gov. (ONR, NSA, NIH, NIST, NASA) around skills and STEM careers
Questions & Discussion

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