



**All – OPAS Workshop
November 17, 2006
OMSI Auditorium**

Advance Materials

Framing the Problem:

Selected quotes:

- *Thomas L. Friedman*: “If the jobs of the new middle [class] require you to be a good collaborator, leverager, adapter, explainer, synthesizer, model builder, localizer, or personalizer, and these approaches require you, among other things, to be able to learn how to learn, to bring curiosity and passion to your work, to play well with others, and to nurture your right brain skills, what does that mean specifically for education?” *from THE WORLD IS FLAT: UPDATED AND EXPANDED EDITION. Farrar, Straus and Giroux, New York, 2006.*
- *Thomas L. Friedman*, “*Q and A with Thomas L. Friedman*”, *New York Times TimesSelect*, November 5, 2006: “... in a flat world, certain kinds of work will migrate faster, and for the first time that work is skilled, white-collar work, not just blue-collar manufacturing.

But there is only one answer and that is entrepreneurship and education. Look how many engineers and math experts Google has hired - in America and abroad. Growing businesses now grow businesses everywhere. I can't believe that someone with sound engineering skills cannot get a job today in America - but you may have to relocate to a different city or a different industry to do it. The job market is changing rapidly, and that is why the ability to learn how to learn is the single most important survival skill anyone can have.”

(<http://select.nytimes.com/2006/11/05/timesselect/06friedman-ga.html?adxnnl=1&adxnnlx=1163034015-VHPPIG0xecXvMn7FbVChwg>)

- *American Society for Engineering Education*: “At a time when the nation needs more engineers to stay competitive, ASEE’s new numbers show declining enrollments, particularly among women ... engineering graduation and enrollment rates at U.S. universities are not keeping up with the country’s increasing demand for engineering talent ... on a per-capita basis, less than 5 percent of all undergraduate degrees were awarded to engineers [in 2004-05], compared with almost 8 percent in 1985 ...” (“*Trouble on the Horizon*,” *ASEE Prism*, Volume 16, No. 2, October 2006 - http://www.prism-magazine.org/oct06/feature_trouble.cfm)
- *National Academies: Rising Above the Gathering Storm*: “The United States takes deserved pride in the vitality of its economy, which forms the foundation of our high quality of life,

our national security, and our hope that our children and grandchildren will inherit ever-greater opportunities. That vitality is derived in large part from the productivity of well-trained people and the steady stream of scientific and technical innovations they produce. Without high-quality, knowledge-intensive jobs and the innovative enterprises that lead to discovery and new technology, our economy will suffer and our people will face a lower standard of living. Economic studies conducted even before the information-technology revolution have shown that as much as 85% of measured growth in US income per capita was due to technological change.”

- Recommendation A¹: Increase America’s talent pool by vastly improving K12 science and mathematics education.
 - Implementation Actions: Scholarships; professional development; increase the number of students passing AP and IB science and math courses.

http://opas.ous.edu/Committees/Resources/Publications/Rising_Above_Gathering_Storm_Execsum.pdf

- *Association for Career and Technical Education, ACTE Issue Brief: Competitiveness* : “Europe, Canada, South Korea, and many other countries around the world have launched ambitious competitiveness agendas to increase innovation, develop technology, and make it easier for businesses to invest in new research and development to spur economic growth. In order to stay on top of the economic productivity around the world, America must continue to innovate and evolve, as it has many times throughout history ... High-quality CTE [Career and Technical Education] can ensure America’s future competitiveness through increased student engagement, the innovative integration of math, science, and literacy skills, and by meeting the needs of both employers and the economy as a whole.”

Baselines and Trends

- Occupational Outlook for the US, 2004 - 2014 (*Source: United States Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/emp/>*)
 - Table 2. Employment by major occupational group, 2004 and projected 2014 (<http://www.bls.gov/news.release/ecopro.t02.htm>) includes
 - Computer and mathematical science occupations are projected to grow 30.7% by 2014, employing an additional 967,000 people.
 - Architecture and engineering occupations are projected to grow 12.5%, employing an additional 314,800 people.
 - Installation, maintenance, and repair occupations are projected to grow 11.4%, employing an additional 657,000 people.
 - Note: Above increases do not include need for replacements to those leaving workforce.
 - Table 3c. The 10 Fastest Growing occupations, 2004 – 2014 (<http://www.bls.gov/news.release/ecopro.t05.htm>) includes
 - 2. Network systems and data communications analysts: 55% (126,000)

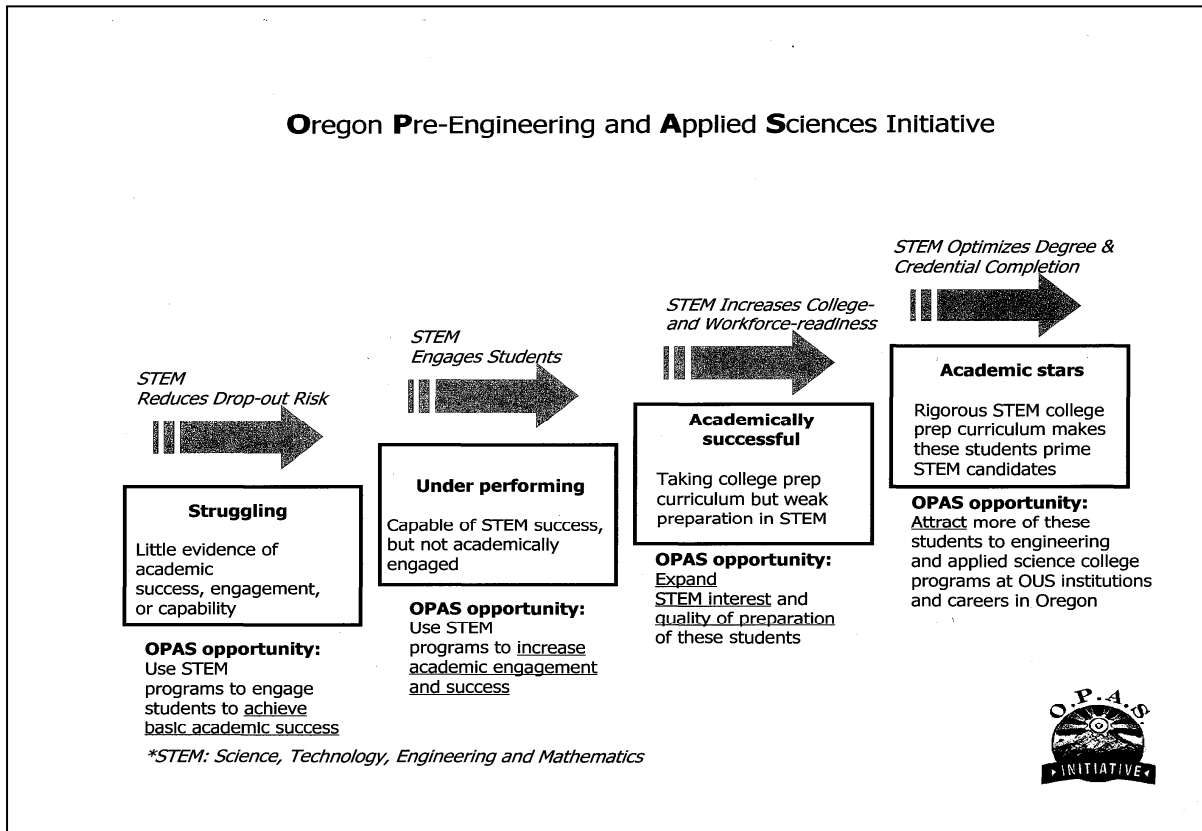
¹ The report makes three other recommendations in areas such as research, patent policy, etc.

- 5. Computer software engineers, applications: 48% (222,000)
 - 8. Computer software engineers, systems software: 43% (146,000)
- Occupational Outlook for Oregon, 2004 - 2014 (*Source: Brenda Turner, Occupational Economist, Oregon Employment Department. For more complete data, http://opas.ous.edu/Committees/Resources/Data/OR_Occupational_Outlook_2004_2014.xls, http://opas.ous.edu/Committees/Resources/Data/OR_Occupational_Outlook_2004_2014.pdf and <http://www.qualityinfo.org/olmisj/OlmisZine?zineid=00000001f>*)

Recommended Education	2004 Employment	2014 Employment	Growth	Growth + Replacement Openings	Needed vs 2004
All	93,829	107,166	14.2%	32,461	34.6%
Doctorate	39	45	15.4%	20	51.3%
Master's	27,482	30,750	11.9%	9,444	34.4%
Bachelor's	39,505	46,685	18.2%	13,600	34.4%
Associate	19,689	21,583	9.6%	6,620	33.6%
Post-secondary Training	7,114	8,103	13.9%	2,777	39.0%

- Data on SAT-takers from 1996 – 2006 who intended to become CS, Engineering, and Biological Sciences majors show that Oregon students choose engineering and biological sciences much like their peers across the nation; Oregon students have been less likely to choose Computer Science since 1997.
<http://opas.ous.edu/Committees/Resources/Data/SATCollegeBound06.xls>
- Oregon students who complete two or more courses in the same approved Professional Technical Education (PTE) program have outperformed other students in meeting or exceeding state standards for Reading/Literature, Writing, and Math Multiple Choice from 2001 to 2005; while the number of PTE students is slowly rising, the total number of credits they earn is falling. (2006 data not yet available – 2004-2005 Oregon PTE Statistical Snapshot - http://opas.ous.edu/Committees/Resources/Data/ODE_PTE_2004_Stat_Snapshot.pdf).
- The percentage of students enrolled in high school who are also enrolled in upper-level college-preparatory track mathematics and physical sciences varies widely in an informal sampling of high schools in and around Portland metropolitan area. The highest enrollment number for 2005-2006 Academic year for pre-calculus was 14.2% in Corbett.
http://opas.ous.edu/Committees/Resources/Data/ACSW_HS_CPrep_STEM.pdf).

Framing our Common Understanding



- **OPAS Vision for the year 2020:** All Oregonians have the opportunity to choose and successfully pursue engineering or applied science as their field of study and career, thereby helping Oregon’s industries contribute to state economic needs, and innovate and prosper in the global economy.
- **OPAS Mission:** To increase the number of work-ready engineers and applied scientists in Oregon through collaboration of education sectors, industry, and government stakeholders that ensures that all K-12 students have access to high quality education and career exploration opportunities that prepare them for postsecondary and workplace opportunities and success.
- **Committee Reports:**
 - **Diversity Committee: “Fostering Stem Diversity”, by Eda Davis-Butts**
Abstract: Diversity is important to STEM fields to increase the pool of students and the availability and vitality of viewpoints and solutions in these fields. Much research identifies barriers that limit the participation and success of female and minority students, non-academic and academic best practices that engage student in STEM,

and vital components of STEM experiences for students, parents, and teachers.

Effective STEM diversity programming should include :

- building sustained, supportive learning environments to help youth move along the STEM educational and career pathways;
- fostering more positive youth attitudes toward school and learning;
- encouraging youth's intrinsic motivation to learn;
- building visions for entering higher education, and support the learning of academic knowledge and skills to prepare for higher education STEM study and careers; and
- maintaining a strong, ongoing professional development component enabling both content knowledge and classroom practice.

○ **Standards, Courses, and Curricula (SCC) Position Statement -**

Abstract: The SCC Committee believes engineering problem-solving and processes must be made part of standards, assessments, and curricula for math and science. Several states and national organizations have developed good models. Partnerships between K-12, higher education, and industry must be developed to incorporate applied and active learning into the classroom. Professional and Career Technical Education (PTE/CTE), AP, IB, respect for rigorous academic content and technical literacy (not technology use) and career counseling can play a vital role in ensuring that all high school students have the opportunity to graduate ready for any pre-engineering program.

○ **Alignment and Coordination: System-Wide and Career Pathways**

(ACSW/CPTH): Flyover Career Pathways diagram. The committee envisions a career pathways diagram that shows when choices between courses limit future options, especially for high school students, and can be used as the basis for the universal career pathways website originally envisioned at the OPAS summit. We are experiencing technical difficulties transitioning from the whiteboard/napkin stage to the electronic document stage, but hope to have something to show at the workshop.

- **Student Success: Access, Motivation, Retention:** the “Sparking an Interest in Engineering” survey closes November 13; preliminary results will be available at the Workshop. The survey asks three populations (high school students, college students, working professional) when they decided they had an interest in STEM, and what triggered and/or nurtured it, among other things.

Framing our Process for Prioritizing Action:

OPAS Goals for the Workshop

- Accelerate the pace of the OPAS Initiative;
- Prioritize existing OPAS strategies to identify the top three to six strategies on which to focus our time and energy for the coming year and guide resource allocation in the upcoming biennium.
- Identify strategies for increasing resources available to OPAS; and
- Update all members on OPAS activities, recommendations, data, and resources.

A Common Vocabulary for the Day:

- **Strategy:** Allocation of resources towards a particular goal at the possible expense of other goals.
- **Method:** General approach to implementing a strategy. Possible methods include:
 - **Policy:** Work with boards, councils, governmental staff and others to establish a common goal and allocate resources towards achieving that goal.
 - **Funding:** Obtain funding for a strategy, establish a process for distributing funds best suited to implement the strategy, implement this process, and monitor the result.
 - **Collaboration:** Identify organizations with common goals, develop joint plans, and implement these plans.
 - **Professional Development:** Offer workshops, courses, and support structures to those already working with students and educators to enhance their knowledge and effectiveness.
 - **Formal Education:** Enhance what is taught, and how it is taught, to students in the classroom and lab.
 - **Informal Education:** Augment what is available in formal classrooms with extracurricular programs and activities in a variety of settings.
 - **Grass roots:** Pull together small groups of people with the latitude and motivation to take independent action, develop and deploy prototype solutions, and grow the ones that work best.
- **Sub-strategies:** The choice of one or more methods for implementing a particular strategy together with interpretations of the chosen methods in the context of the strategy.
- **Tactic:** A specific action associated with a plan to implement a strategy or sub-strategy.

Suggested Criteria for Prioritizing Choices Among Strategies:

- How well does this choice *align with OPAS' vision, mission and goals*? Does this strategy serve to increase the number of work-ready engineers and applied scientists in Oregon?
- How much potential does this choice have to *reduce obstacles to student success*, which might include, but are not limited to access, preparation, appropriate habits of mind, socio-cultural factors, and awareness of options?
- What is the *breadth of impact* of this choice? How many students would be affected?
- What is the *depth of impact* of this choice? To what extent will the strategy engage students or others in a way that will cause depth of understanding or long-term change in behavior?
- Is this strategy a *prerequisite for other high-priority strategies*?
- Are the *resources* required to implement this choice of strategy *available*? How readily? Is there risk associated with acquiring those resources?
- Does this strategy *leverage the work of others* or present opportunities for *synergistic collaboration*?
- How well does this *match the expertise, connections, and passions* of OPAS members? Is this strategy exciting enough to encourage the recruitment of new members?

OPAS Strategies for Student Success:

Motivation: Enhance students' knowledge of degree and career opportunities and increase their motivation to pursue these opportunities.

- Document and communicate to students within the curriculum a variety of pre-engineering and applied science degree and career pathways.
- Improve collaboration between informal STEM² education programs towards common goal of increasing students' interest and knowledge of engineering and applied science opportunities.
- Improve number and diversity of students participating in informal STEM programs.

Preparation: Increase the number of students prepared for college-level work in engineering and applied science as well as the depth of that preparation.

- Collaborate in improvements to Oregon's STEM standards and assessments.
- Increase the number of schools that provide high-quality opportunities for students to learn about pre-engineering and applied science.
- Increase the use of improved teaching methods: active learning, student inquiry, engineering problem solving, and creative teamwork.

Transfer, Diversity, and Retention: Increase alignment between STEM educational levels, increase diversity of students participating in STEM programs, and enhance retention rates in engineering & applied science programs.

- Assure that the outcomes of courses are aligned with the prerequisites of more advanced courses.
- Increase the enrollment and successful completion of STEM courses by young women, minorities and students in poverty through outreach programs and other methods.
- Improve retention rates of college programs, both generally and in specific underrepresented populations.

Most materials cited here are also available on the OPAS Master Resources List at <http://opas.ous.edu/Committees/Resources/>, a sortable, searchable table of articles, publications, working papers, and data of interest to OPAS stakeholders.

² STEM: Science Technology Engineering & Mathematics.