

BREAKOUT SESSION

Building Capacity In Higher Education in Critical Disciplines

- **A summary of academia's position and initiatives in educating candidates for the national security workforce and a discussion of new initiatives that could be taken**

Breakout Session Members

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 - **Richard Carlin**
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Questions Discussed

- 1. What are the most important factors that account for the long-term decline of student interest in a number of critically important fields and specialties including physics, chemistry, and engineering? (e.g. career attractiveness, rigor of curriculum, length and cost of educational investment)**
- 2. Why have rates of attrition remained high in many technical fields, especially for historically under-represented groups that comprise an increasing share of the overall workforce? (e.g. lack of engaged faculty, peer support, costs) What data are available that shed light on the causes of such attrition?**
- 3. How is the influx of international graduate students and faculty in many technical fields affecting the learning environment and perceived opportunities for American students in these fields?**
- 4. What incentives are most likely attract more American students into the hard sciences and engineering? (e.g. scholarships, summer internships, funding incentives for universities).**
- 5. What are the most important steps that government agencies, companies, and universities can take – separately and jointly – to build capacity?**

Questions Discussed

- 1. Are there ways for the Gov't to funnel resources to Universities where the professor allocates to specific US citizen students?**

Questions Discussed

- **1. What are the most important factors that account for the long-term decline of student interest in a number of critically important fields and specialties including physics, chemistry, and engineering? (e.g. career attractiveness, rigor of curriculum, length and cost of educational investment)**

Salary Levels

Educational preparation in primary, middle, and high school

Teachers with inadequate preparation

Lack of accountability for instructors/institutions

Lack of understanding of current or future career paths

Languages – understanding importance of in-country training

Lack of importance of science and technology in the national conscience

Jobs and stability

True expertise is not valued

Time to degree

Lack of role models

Suppression of inquiry and imagination in the middle and high schools

Questions Discussed

- **2. Why have rates of attrition remained high in many technical fields, especially for historically under-represented groups that comprise an increasing share of the overall workforce? (e.g. lack of engaged faculty, peer support, costs) What data are available that shed light on the causes of such attrition?**
- **Inadequate preparation in high school**
- **Lack of mentoring**
- **Lack of role models**
- **Work ethics**
- **Lack of clear articulation of degrees and time horizons**
 - What can be done with each degree
- **Peer pressure**
- **Lack of importance of science and technology in the national conscience**
- **Teachers are not incentivized to provide mentoring – large classes, little contact, etc.**
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- **View that graduate degrees translate into teaching and nothing else**

Questions Discussed

- **3. How is the influx of international graduate students and faculty in many technical fields affecting the learning environment and perceived opportunities for American students in these fields?**
- **Faculty**
 - Cultural Expectations
 - Foreign faculty may result in decreasing the number of English speaking students due to language barriers
 - May actually decrease the ability to learn effectively
 - With large numbers of international students, the future faculty may be international
- **Students**
 - Language Barriers
 - US students become a minority in some cases and are less comfortable
 - Teaching responsibilities fall to US students (language)
 - Cultural Expectations
 - International students are willing to work for less and live on less, furthering the decline of US students in those positions
 - Language barrier between students in terms of sharing research, etc.
 - Steady supply of hard working and inexpensive foreign students has allowed the educational system to become non responsive to the needs of America. It has masked the disconnect between middle school, high school, and college in science education.
 - Foreign students provide potentially valuable role models and counter-examples to the prevailing cultural (US) norms

Questions Discussed

- **4. What incentives are most likely attract more American students into the hard sciences and engineering? (e.g. scholarships, summer internships, funding incentives for universities).**
- Part-time programs
- Promises to use skills that have required such large investments
- Job security
- Summer internships focused on interesting work, and keeping students engaged over time
- Non need-based scholarship programs for students who complete coursework in the desired areas
- Fund US citizens directly rather than the institution
- Paid internships
- Engage students early in their college career, showing them the application of the work
- Introduction to the desired field at its' application at the correct time in their education. Middle school, high school
- Salaries
- Funding middle and high school teachers to attend summer experience programs at Gov't laboratories
- Emulate existing NSF programs
- Early Socialization of students

Questions Discussed

- **5. What are the most important steps that government agencies, companies, and universities can take – separately and jointly – to build capacity?**
- **Separately**
 - Would recommend joint steps.
 - Universities should address the attrition issues
 - Similarly, each sector should address issues where they can affect change
- **Jointly**
- **Begin dialog with teachers unions, PTAs, etc.**
- **Change the culture of how we perceive S&T**
- **Coordinated effort across labs and agencies to generate interest at early ages.**
- **Federal, industrial, and Academic partnerships**
 - Create innovative degree programs to promote inclusion
 - Address the inadequacy in teacher training
- **Clearly identify the shortages and demands**
- **Make it easier for the trained foreign students to stay**
- **Gov't communicate what is needed in terms of S&T and why**
- **Retiring workforce presents an opportunity to address problems in the teaching arena. They can both teach the subject in the context of applications**

Questions Discussed

- **6. Are there ways for the Gov't to funnel resources to Universities where the professors allocates it in certain fields to US citizen students?**
- Equal opportunity policies will make this difficult
- Define a training program and indicate requirements and it should be doable.

- **A shortage of linguists and an inadequate pipeline of qualified future US engineers and scientists exists and the situation is getting worse in specific national security areas**
- **Multiple barriers**
- **Cultural change needed**
- **Better incentives needed**
- **Unified approach needed**
- **Motivation of S&T must start early in academic career**
- **Systemic Problem; requires systemic approach**
- **Pervasive national security issue**
- **Urgent – need to fix it now and maintain it**
- **Mentor rich environment**

- **Existing culture regarding these skill areas**
- **Poor math and science literacy**
- **Inadequate market incentives**
- **Inadequate teacher training**
- **Lack of comms regarding demand and opportunities**
- **Lack of common metric and process for assessing and representing requirements**
- **Fragmented efforts rather than joint, with a common goal**
- **Lack of national imperative**
- **Lack of a political champion**
- **Salary scales**
- **Political correctness of American dependencies on international skills**

Recommended Actions

RECOMMENDED ACTION	RECOMMENDED ACTION ORGANIZATION	RECOMMENDED RESULT
<p>Charter an organization to bring coherence to the multitude of independent activities. e.g. Establish a clearinghouse of information. , utilize behavioral science community to collaborate.</p>	<p>NRC</p>	<p>Unified, systemic National strategy</p>
<p>Build an interface (and resource appropriately) with the academic community (K-16) into the job requirements for employees and scholarship recipients in the needed skill areas</p>	<p>Each and every agency</p>	<p>Thousands of ambassadors</p>
<p>Launch a national public awareness/media campaign (TV show, commercials) around the importance of STEM/ foreign language education and advocacy.</p>	<p>NSF, AAAS, ASEE, chartered organization above</p>	<p>Shift in the cultural perception of STEM</p>
<p>Create partnership in support of increase National Security R&D investment between industry, Gov't (including NSF, NIH, DOE office of science, etc.), Academe, and the international community</p>	<p>OSTP</p>	<p>Increased global technology awareness, and an increased pool of talent.</p>

Recommended Actions

RECOMMENDED ACTION	RECOMMENDED ACTION ORGANIZATION	RECOMMENDED RESULT
<p>Initiate programs to enhance national security related education,</p> <ul style="list-style-type: none"> –Revise aspects of NDEA 1958 for NDEA 2006. –Gain state and local gov’t support for employing former national security professionals as teachers of both the subject matter and applications in public schools –Establish a vigorous presidential early career awards program for national security scientists and engineers to build university faculty in areas of high value to national security –Use training grants to support US citizen STEM students for national security careers in critical skills areas with requirements for internships at federal labs –Promote the articulation of 2 year programs with 4 year institutions. –Reenergize the language and advance degree (STEM) programs for Government National Security workforce (including the Officer Corps). 	<ul style="list-style-type: none"> AIA, NDIA AAAS, NGA, Chambers of Commerce NSTC NSTC Association of community and 4 year colleges OPM, DoD, JCS, DHS, etc. 	<ul style="list-style-type: none"> Enactment Teachers who are competent and engaging Increase US citizen tenured STEM professors Increase US citizen trained in STEM critical areas Increase STEM enrollment (US Citizen) in 4 year colleges Larger pool of qualified personnel

Recommended Actions

RECOMMENDED ACTION	RECOMMENDED ACTION ORGANIZATION	RECOMMENDED RESULT
Establish a training program for existing STEM teachers to provide remediation	AAAS, NSTA, NCTM	Improved content knowledge