Políticas de Investigación en Educación, Ciencia y Tecnología
Caso: América del Norte

Dr. WILFRIDO A. MORENO
University of South Florida / USF-ISTEC – USA

Septiembre 20, 2013
Bogotá, Colombia
Outline of Presentation

- USF Overview
- The Grand/Global Challenges
- “Identifying the Need/Problem to Solve”
- Agreeing on the Mission – Leadership
- North America Research Initiatives
  - What is STEM?
- ISTEC Overview
  - Red Iberoamericana Trans-disciplinaria de Investigación en Sistemas Complejos
  - SoS Methodologies
  - On-going Activities by the Members
- Closing Remarks…..
We are not in “South” Florida

Tampa .......
➢ Over 47,000 students (all 50 states, 110 countries)

➢ Second largest in Southeast, top 20 in nation

➢ “Research I” designation by Carnegie Foundation

➢ Over $380 Million in sponsored research

➢ 15 Colleges (Engineering, Medicine, Pharmacy, Education, Arts and Sciences, Marine Science, Business….)
- Affiliated with 4 hospitals (Moffitt Cancer Center, TGH...)
- CAMLS
- R & D Park, Center for Entrepreneurship...
- USF is ranked 44th in total research expenditures and 34th in federal research expenditures for public universities for FY 2009 by the National Science Foundation.
- USF ranks 9th world-wide of 14 universities ranked among 300 organizations that earned the most patents in 2010, according to the Intellectual Property Owners Association.
- Over Seventy professors from Latin America & Mexico have earned their Ph.D. degrees in Engineering since 1991
Scientific Grand Challenges Workshop Series

Engaging science communities to discuss scientific grand challenges and the role of scientific computing


ASCRA is in the process of, in partnership with the other Science program meetings, each focusing on the specific scientific computing in addressing the relevant scientific community. The primary goal of the workshop series is to identify the opportunities and challenges through computing and multi-disciplinary partnerships.

Limited to approximately 50 invited technical leaders in the field of extreme scale computing, with a highly focused agenda targeted at identifying ways to overcome technical issues and produce a report for the U.S. Department of Energy Advanced Scientific Computing Research (ASCR) program office that has the specific scientific domain in its portfolio. The reports will also be available to the broad scientific and general community.

The series is being organized by a coordinating team to ensure the recommendations and common to all meetings.

Source: DOE Office of Science, ASCR
http://www.er.doe.gov/ascr/Misc/GrandChallenges.html
Engineering Grand Challenges

- Make solar energy economical
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure
- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools of scientific discovery

Source: National Academy of Engineering of the National Academies
http://www.engineeringchallenges.org
How do we prepare ourselves to face such challenges?
A Nation at Risk: The Imperative For Educational Reform is the title of the 1983 report of American President Ronald Reagan's National Commission on Excellence in Education. Its publication is considered a landmark event in modern American educational history. Among other things, the report contributed to the ever-growing assertion citation needed that American schools were failing, and it touched off a wave of local, state, and federal reform efforts.
This year marks the 30th anniversary of A Nation at Risk, a seminal report that warned of a “rising tide of mediocrity in the nation’s schools.” Despite the report’s

- The U.S. education system is still mired in mediocrity, continually bested by those of other countries.
- As a result, there are about 4 million unfilled jobs in this country, even though 12 million Americans are out of work. Many unemployed
- Americans simply do not have the educational background and skills to fill those jobs.
Consider these realities....

- The knowledge economy is increasingly dependent on college-educated professionals.

- By 2018, the economy will have created 46.8 million new jobs.

- Nearly two thirds of these will require workers with at least some college education, with a slight majority of these requiring workers with a Bachelor’s degree or better

http://chinagorman.com/2012/03/20/data-point-3-the-u-s-education-deficit-and-46-8-million-new-jobs/
Consider these realities....

- In 2010 only 39% of non-Hispanic whites ages 25-29 had Bachelor’s degrees; for African-Americans (19%) and Hispanics (14%)

- Economic data show that 1 million additional STEM graduates will be needed over the next decade to fill America’s economic demand.

- STEM-based jobs are expected to grow 17% in the next 10 years, outpacing the overall job growth of 10%.
Consider these realities....

- Only 70% of students in public high schools graduate, and only 32% of students leave high school qualified to attend four-year colleges.

- Only 51% of African-American students and 52% of Hispanic students graduate, and only 20% of African-American students and 16% of Hispanic students leave high school college-ready.

- 1.7 million students entering college required at least one remedial course, which cost states and students more than $3 billion annually.
How Does the U.S. Compare to Other Countries in Education?

☑ The World Economic Forum ranks the United States 52nd in the quality of mathematics and science education, and 5th (and declining) in overall global competitiveness.

☑ The United States ranks 27th in developed nations in the proportion of college students receiving undergraduate degrees in science or engineering.

☑ There are more foreign students studying in U.S. graduate schools than the number of U.S. students and over 2/3 of the engineers who receive Ph.D.’s from United States universities are not United States citizens.

© 2013 Level Playing Field Institute.
"Una de las cosas que he estado enfocado como presidente es cómo crear una manera que cubra plenamente la ciencia, la tecnología, la ingeniería y las matemáticas. Tenemos que hacer de esto una prioridad para entrenar a un ejército de nuevos maestros en estas áreas y para asegurarse de que todos nosotros como país estemos elevando estos temas por el respeto que se merece".

President Barack Obama
2013 White House Science Fair
April 2013
"Queremos asegurarnos de que estemos motivando a la gente joven en las áreas de matemáticas, ciencia, tecnología y la informática. No queremos que nuestros hijos sólo sean los consumidores de las cosas increíbles que genera la ciencia; Queremos que sean los productores también. Y también queremos asegurarnos de que aquellos que históricamente no han participado tenazmente en las ciencias — niñas, miembros de las minorías en este país de que también se les fortalezca. Tenemos que asegurarnos de que estamos entrenando excelentes profesores en cálculo y biología y motivar a los estudiantes para que salgan bien en sus clases de física y química..... Significa enseñar métodos de investigación adecuados y animar a la gente joven a desafiar el conocimiento ya aceptado."

President Barack Obama
National Academy of Sciences
April 2013
**Mission:** Sending and bringing back an American safely to the Moon before the end of the decade

May 25, 1961

Neil Armstrong stepped off the Lunar Module's ladder and onto the Moon's surface

July 16, 1969

July 21, 1969

July 24, 1969
There is a “Clear Mission” in the U. S. to teach the integrative subjects of Science, Technology, Engineering, and Mathematics (STEM)
The STEM Strategic Plan sets out ambitious national goals to drive Federal investment in five priority STEM education investment areas:

1. Improve STEM Instruction:
   - Prepare 100,000 excellent new K-12 STEM teachers by 2020, and support the existing STEM teacher workforce;

2. Increase and Sustain Youth and Public Engagement in STEM:
   - Support a 50 percent increase in the number of U.S. youth who have an authentic STEM experience each year prior to completing high school;

3. Enhance STEM Experience of Undergraduate Students:
   - Graduate one million additional students with degrees in STEM fields over the next 10 years;
The STEM Strategic Plan sets out ambitious national goals to drive Federal investment in five priority STEM education investment areas:

4. Better Serve Groups Historically Under-represented in STEM Fields:
   ✓ Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years
   ✓ Improve women’s participation in areas of STEM where they are significantly underrepresented;
The STEM Strategic Plan sets out ambitious national goals to drive Federal investment in five priority STEM education investment areas:

5. Design Graduate Education for Tomorrow’s STEM Workforce:

- Provide graduate-trained STEM professionals with basic and applied research expertise
- **Mission-critical workforce needs for the CoSTEM agencies**
- Additional skills needed for success in a broad range of careers
1. Improve STEM Instruction: Prepare 100,000 excellent new K-12 STEM teachers by 2020, and support the existing STEM teacher workforce;

- Research shows that top-performing teachers make a dramatic difference in student achievement and suggests that for students who learn from these teachers year after year, achievement gaps narrow significantly.

- Every teacher and education leader deserves access to the preparation, on-going support, recognition, and collaboration opportunities needed for success.
2. Increase and Sustain Youth and Public Engagement in STEM: Support a 50 percent increase in the number of U.S. youth who have an authentic STEM experience each year prior to completing high school;

- “Authentic STEM experience,” CoSTEM means a designed experience inside or outside of school in which learners engage directly in doing STEM.

- This broad designation covers a range of commonly referenced notions, from “hands-on” science, to problem-based learning, to inquiry.
Only 43 percent of students entering as a STEM major in a four-year public college or university graduate with a STEM degree.

Economic projections suggest the need for as many as one million additional STEM professionals over the next decade above current graduation rates.

That includes STEM majors at a variety of skill and knowledge levels from community college graduates, to quality STEM teachers, to scientists and engineers with advanced degrees.

3. Enhance STEM Experience of Undergraduate Students: Graduate one million additional students with degrees in STEM fields over the next 10 years;
Federal Agencies will Focus on two main STEM Education Coordination Approaches:

1. Build new models for leveraging assets and expertise.

  ✓ Implement a strategy of lead and collaborating agencies to leverage capabilities across agencies to achieve the most significant impact of Federal STEM education investments.
2. Build and use evidence-based approaches.

- Conduct STEM education research and evaluation to build evidence about promising practices and program effectiveness, to be used across agencies, and share with the public to improve the impact of the Federal STEM education investment.
NSF in a Nutshell

- Independent Agency
- Supports basic research
- Uses grant mechanism
- Low overhead; highly automated
- Discipline-based structure
- Cross-disciplinary mechanisms
- Use of Rotators/IPAs
- 2014 budget request: $7.626 billion
STEM Initiatives

- NSF Graduate STEM Fellows in K-12 Education (GK-12)
- National STEM Education Distributed Learning (NSDL)
- Alliances for Broadening Participation in STEM (ABP)

Just three examples . . . .
NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)

- Goal: Provide scholarships to academically talented, financially needy students pursuing associate, baccalaureate, or graduate degrees, uses FAFSA Federal Student Aid

  - Full Proposal: August 13, 2013
Two Funding Criteria

- Intellectual merit
- Broader impacts
Intellectual Merit?

- NSF funds basic research & NSF funds basic research
- Intellectual merit means increasing knowledge through developing and examining basic theories or methods
Broader Impacts

NSF values the advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes

- Full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM)
- **Improved STEM education and educator development at any level**
- Increased public scientific literacy and public engagement with science and technology
- **Globally competitive STEM workforce**
- Increased partnerships between academia, industry, and others;
- Enhanced infrastructure for research and education.
Directorate for Engineering

Research Experiences for Teachers (RET) in Engineering and Computer Science

CONTACTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary Poats</td>
<td><a href="mailto:mpoats@nsf.gov">mpoats@nsf.gov</a></td>
<td>(703) 292-5357</td>
<td>585 N</td>
</tr>
<tr>
<td>Harriet G. Taylor</td>
<td><a href="mailto:htailor@nsf.gov">htailor@nsf.gov</a></td>
<td>(703) 292-8950</td>
<td>1175N</td>
</tr>
</tbody>
</table>

PROGRAM GUIDELINES

Solicitation 11-509

Important Notice to Proposers

A revised version of the NSF Proposal & Award Policies & Procedures Guide (PAPPG), NSF 13-1, was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that, depending on the specified due date, the guidelines contained in NSF 13-1 may apply to proposals submitted in response to this funding opportunity.

Please be aware that significant changes have been made to the PAPPG to implement revised merit review criteria based on the National Science Board (NSB) report, National Science Foundation’s Merit Review Criteria: Review and Revisions. While the two merit review criteria remain unchanged (Intellectual Merit and Broader Impacts), guidance has been provided to clarify and improve the function of the criteria. Changes will affect the Selection Criteria checklist form and the Award Guide. NSF 13-1 supersedes NSF 12-021. Your proposal should be submitted to the relevant program director, as identified on the NSF 13-1 guide, for the Division of Engineering, which funds this program. For more information on the new guidelines, visit: http://www.nsf.gov/pubs/2012/nsf12021/nsf12021.jsp.
Research Experiences for Undergraduates (REU)

NOTE ON THE PROPOSAL DEADLINE FOR REU SITES

Two due dates are listed for REU Site proposals each year. The May deadline applies only to REU Site proposals that require access to Antarctica, which must be submitted to one of the Antarctic Sciences Division (ANT) research programs in the Office of Polar Programs (OPP). The fall deadline (which is September 12 in 2012, and the fourth Wednesday in August in 2013 and beyond) applies to all other REU Site proposals.

CONTACTS

NSF REU Site Contacts: http://www.nsf.gov/crssprgm/reu/reu_contacts.jsp

PROGRAM GUIDELINES

Solicitation 13-542

Important Notice to Proposers

A revised version of the NSF Proposal & Award Policies & Procedures Guide (PAPPG), NSF 13-1, was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that, depending on the specified due date, the guidelines contained in NSF 13-1 may apply to proposals submitted in response to this funding opportunity.
The DHS Science and Technology Directorate (S&T) is the primary research and development arm of the Department of Homeland Security and manages science and technology research, from development through transition, for the Department's operational components and first responders to protect the homeland.

Established by Congress to provide innovative solutions to the nation's homeland security challenges, S&T is the core source of scientific and engineering expertise for the Department and uniquely postured to enhance our nation's security and resiliency.
The mission of the Energy Department is to ensure America’s security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

Catalyze the timely, material, and efficient transformation of the nation’s energy system and secure U.S. leadership in clean energy technologies.

Learn more
There is a “growing movement” in the U. S. to teach the integrative subjects of Science, Technology, Engineering, and Mathematics (STEM)
What is STEM Education?

STEM is the integration of Science, Technology, Engineering, and Mathematics into a new trans-disciplinary subject in schools.
Offers a chance for students to make sense of the world rather than learn isolated bits and pieces of phenomena
Science seeks to understand the natural world.

National Science Education Standards, National Research Council, 1996.
What is the Goal of Technology?

The goal of technology is to make modifications in the world to meet human needs.

(National Science Education Standards, NRC, 1996)
Why is STEM Education so Important?

“For a society so deeply dependent on technology and engineering, we are largely ignorant about technology and engineering concepts and processes, and we have largely ignored this incongruity in our educational system.”

(Bybee, 2000)
Increasing the Achievement and Presence of Under-Represented Minorities in STEM Fields
Progress on STEM is critical to building a just and inclusive society:

- STEM participation and achievement statistics are especially disturbing for women and minorities, who are substantially underrepresented in STEM fields.

- Earned a first university degree in the natural sciences or engineering by age 24
  - 2.2 percent of Hispanics and Latinos
  - 2.7 percent of African Americans
  - 3.3 percent of Native Americans and Alaska Natives
Advances in Science, Technology, Engineering, and Mathematics (STEM) are required for Nation’s Ability

➢ While women constitute the majority of students on college campuses and roughly 46 percent of the workforce:

✓ They represent less than one in five (20%) bachelor’s recipients in fields like computer science and engineering

✓ Hold only 25 percent of STEM jobs
Hispanic now make up 17 percent of the nation’s population, up from 13 percent in 2000.

In the period between 2000 and 2011, the Hispanic population grew 48 percent.

But as the nation’s Latino population continues to grow, it is not because of immigration. In fact, foreign-born Latinos are now 36 percent of the nation’s Hispanics.

“As immigration has slowed, the big driver in Latino growth is births,” says Mark Hugo Lopez, Associate Director of the Pew Hispanic Center.
Key factors that contribute to student Success across all groups*

➢ Student engagement
➢ Motivation
➢ and exposure to STEM subjects.

*By the National Math and Science Initiative
Student Engagement

- Students who are engaged and active in the classroom are more apt to increase their critical thinking skills.
- A K-12 system that does not emphasize instructional rigor will not adequately prepare students for the modern workforce or challenging college coursework.
- We should not be afraid to challenge students – in fact, challenging students is the key to active student engagement.
- It has had a tremendous impact on African-American and Hispanic students; in just one year of program participation, schools typically see a 200% increase in the number of students passing an AP exam.

*By the National Math and Science Initiative*
Motivation

- As college graduation rates among minorities increase, underrepresented groups in STEM fields have more role models to inspire them.
- Another big factor in determining a student’s motivation to increase academic achievement is their capacity to complete rigorous coursework, a skill that can only be acquired through effective classroom experiences.
- Engaging various stakeholders such as parents and community members also helps construct a positive learning environment where students are motivated to succeed.
- With better preparation these students could thrive in a college setting, continuing with a major about which they are passionate.

*By the National Math and Science Initiative*
Exposure to STEM Subjects

- Not only is early exposure to STEM subjects important, being surrounded by a community of STEM professionals is vital.
- Student participation in active research, hands-on experience and proven programs all increase student persistence and graduation in STEM majors.
- Creating the pipeline for the future STEM workforce is highly dependent upon effective STEM teachers.
- Recruiting the right people to become teachers and developing them into effective instructors are two of the most important factors in driving improved performance in schools.

*By the National Math and Science Initiative*
Summary and Call to Action

- In conjunction with more emphasis on STEM education at a young age, complementary activities outside of the classroom can increase student engagement in STEM fields.
- With commitment and the proper tools, we can make an impact on all students and increase STEM talent in the U.S., including under-represented minorities.
- Now is the time to invest in the future of students and our STEM workforce.
- The success of NMSI’s programs and other STEM initiatives depend on robust funding mechanisms and streamlining of national STEM programs.

*By the National Math and Science Initiative*
The National Math and Science Initiative (NMSI) was founded to address one of this nation’s greatest economic and intellectual threats:

- The declining number of students who are prepared to take rigorous college courses in math and science and be equipped for careers in the knowledge-based economy.

- As we create strategies for promoting STEM education, it is important to create best practices based on proven programs and measurable results.

*By the National Math and Science Initiative*
Three Year Results - Percentage Increases in Qualifying Math/Science/English AP Scores

*By the National Math and Science Initiative*
ATE Program

- Focus: education of science and engineering technicians for high-technology fields that drive the nation’s economy.
- Grades 7-12, 2yr- and 4-yr
- Community and technical colleges
- Proposals due Oct. 17, 2013
Division on Research and Learning in Formal and Informal Settings (DRL)

Innovative Technology Experiences for Students and Teachers (ITEST)

- Program seeks solutions to help ensure the breadth and depth of the STEM workforce.
- Projects must include students and can include teachers.
- ITEST is emphasizing the design and implementation of robotics competitions to study their effectiveness as a means of engaging students in learning STEM content and 21st Century skills.
CAREER AND TECHNICAL EDUCATION
FIVE WAYS THAT PAY
September 2012

ALONG THE WAY TO THE B.A.

2012

STEM
SCIENCE
TECHNOLOGY
ENGINEERING
MATHEMATICS

ANTHONY P. CARNEVALE
NICOLE SMITH
MICHELLE MELTON

2011
More on STEM Workforce

2012

Figure 1: Sustained Growth is Projected for STEM Occupations
Employment as a Percentage of 2006 Employment, by Occupation

Computer Occupations
Life Sciences
Mathematical Sciences
Physical Sciences
Engineering
All Occupations (STEM and non-STEM)

Source: Chairman’s staff of the Joint Economic Committee based on data from the Bureau of Labor Statistics. The BLS does not project employment for individual years from 2010-20. For the purposes of this chart, Life Sciences excludes Medical Sciences.
A Focus on Community Colleges
Cultivating Tomorrow’s Workforce Through STEM Experts

In today’s technology-driven world, younger generations tend to quickly adopt the latest innovations in our ever-changing high tech landscape; however, through the Florida High Tech Corridor Council’s workforce initiative, techPATH, students can learn how they can create those innovations, too.

For 15 years, techPATH has connected Corridor universities – the University of Central Florida, the University of South Florida and the University of Florida – state and community colleges, and private sector companies with teachers and students to demonstrate exciting high tech careers and the skills needed for a student to prepare for technology-based jobs.

techPATH has delivered nearly 90 programs to more than 3,000 teachers and students within the 23-county Corridor region while expanding with new programs to meet changing needs. By transforming complicated principles into interesting concepts that have real-world applications, techPATH empowers students to study STEM fields (Science, Technology, Engineering and Math) in a different light.

An ongoing partnership between techPATH and state and community colleges allows students to explore further career possibilities in their own backyard. Local colleges host workshops, called techCAMPs, to showcase STEM fields and concentrations within their departments, allowing a classroom of students to spend the day participating in active discussions and demonstrations while being introduced to ways they can continue their education locally.

An extension of techPATH’s state and community college program delivers academic experts directly to students without having to leave the classroom. Conducted as an entirely virtual experience, stemCONNECT provides teachers with dynamic guest speakers who can teach their students a variety of STEM subjects through an interactive online conferencing session. The free program allows students to ask questions and interact with the speaker from his or her office, classroom or laboratory anywhere in the Florida High Tech Corridor. A trial stemCONNECT program has already been delivered to an Orange County middle school class on the topic of simulation.

For more information, visit www.floridahightech.com/techpath.php.
Department of Secondary Education

STEM Projects and Initiatives

Current and Ongoing Projects

1. USF is a committed member of the Science Mathematics Teacher Imperative (SMTI) to transform middle and high school science, technology, engineering and mathematics (STEM) education by preparing a new generation of world-class science and mathematics teachers.

- **SMTI Mathematics Teacher Education (MTE) Partnership.** As part of this effort, the Department of Mathematics and Statistics and Hillsborough County Public Schools have partnered with the mathematics education program faculty in the MTE-Partnership. The SMTI MTE Partnership effort will provide a coordinated research and development effort for secondary mathematics teacher preparation programs in order to meet the challenges of the Common Core State Standards for Mathematics and to embody research and best practices in the field.
Project ASAP (Accelerated STEM Academic Pipeline): Graduate Certificate Program for Title 1 Middle School Teachers

Funded by the Helios Foundation for $844,815; 11/30/12 - 11/30/14

Project ASAP provides funds to support teachers who complete a 12-credit hour Graduate Certificate in Integrated STEM (Science, Technology, Engineering, and Mathematics) education designed to prepare them to work in Title 1 middle schools. The certificate program is designed to improve content expertise, pedagogical skills, & interdisciplinary knowledge; the courses are infused with inquiry, problem-based learning, and links to literacy, engineering, and technology. The graduate certificate program includes a mathematics and a science track, which combine to include a course on ESOL/literacy and an integrated math/science course. The courses are offered in Lakeland, drawing teachers from the high needs/underserved rural and urban areas of Polk, Sarasota, Manatee and Eastern Hillsborough counties.
The goals of the planning effort are to:

Develop a new Teacher Education program to prepare middle school STEM teachers that takes into consideration middle school students’ developmental needs, curricular expectations. Overall, this program will be research-based; make links to practice through a yearlong residency program; provide ongoing professional development for clinical faculty, cooperating teachers, and residents;
The USF Robert Noyce (STEM) Scholars program provides $30,000 stipends to 31 graduating seniors, recent graduates, and career changers who are interested in earning their teaching credentials in mathematics or science by enrolling in a one-year accelerated Masters of Arts in Teaching (MAT) program as a full time student.
STEM Education Center

Welcome to the STEM Education Center in the Department of Mathematics and Statistics at the University of South Florida. The Center offers challenging educational programs for gifted high school students. The Center’s aim is to promote creativity and provide Pre-college students with an in-depth understanding of the various STEM fields. Through exploration and research the methods and applications of mathematics, computer science, the physical and biological sciences, as well as technological innovations and inventions are presented.

SEC’s genesis at USF goes back to 1971. Since 1979 the Center has been offering summer programs for gifted high school students continuously. For information regarding the 2013 Summer Program please go to our website at www.uc.usf.edu/stem/.

Information for the Fall 2013 Integrated STEM and 3D Visualization program can be found at math.usf.edu/outreach/stem_3dv/. A printable flyer for the program can be downloaded here.

A Sample of Research Papers Produced by Program Participants

Below is a sample of research projects produced during the past two years by students entering 12th grade and mentored by USF faculty:
Program Overview

The STEM Education Center at the University of South Florida (USF) offers a challenging educational summer program for gifted high school students entering grades 11 and 12. Its aim is to promote creativity and provide the participants with an in depth understanding of the STEM fields. Through exploration and research, the methods and applications of mathematics, the physical and biological sciences, as well as technological innovations and inventions are presented.
ISTEC
The Iberoamerican Science & Technology Education Consortium
Industry-Academia Network of 70+ members

Dedicated to promoting STEM education in Iberoamerica since 1990
Be a leading force in fostering socio-economic and educational change in Ibero-America, by creating prosperity and improving the quality of life in the region.

- Building **installed capacity**
- Creating communities of **knowledge & practice**
Strategic Areas of Focus

Quality & Accreditation

Access to Information

Technology Transfer / Joint R&D Collaborations

Innovation & Entrepreneurship

Virtual Education
Research & Development

Technology transfer & capacity building

Results Over Two Decades:
Many labs established, equipment donated, thousands of engineers trained in a variety of technologies (DSP, FPGA’s)

Partnerships with Industry Members:
Xilinx – 5 FPGA Workshops, 100 participants
Centers of Excellence: Ecuador, Colombia, Perú

Aldebaran Robotics – NAO Robots + Training + Student Contest
R&D Laboratories Initiative

GOAL: Design, install and train of Modular, Flexible, and Expandable Laboratory Facilities for Education, Training, and R&D in conjunction with industrial Partners).


TECHNOLOGIES: Motorola microprocessors (680XX), microcontrollers (68HC11) and DSPs (M-Core), (56XXX) & StarCore). Microsoft, Sun Microsystems, Nortel Networks, Fluke, VeriBest, Synopsis, National Instruments, Quanser, XILINX, A-WIT, etc
The TWR-K60D100M is a development tool which is enabled by Kinetis 60 MCU family built on ARM® Cortex™-M4 core.

The FRDM-KL25Z is an ultra-low-cost development platform enabled by Kinetis 10/20 MCUs families built on ARM® Cortex™-M0+ processor.

The Freescale Cup Program through – Phase I

Programmable through – Phase II

Lab Kits

LabVIEW

Student Portable Lab Kits

CodeWarrior Development Studio

mbed
Universidad Distrital, Bogotá – Colombia

MACROPROYECTO "LAS TECNOLOGÍAS DEL SIGLO XXI"

PROYECTO DE INVESTIGACIÓN DE LA DIDÁCTICA PARA LA ENSEÑANZA DE LA nanoCIENCIA Y LA nanoTECNOLÓGÍA EN LOS COLEGIOS DISTRITALES DE SECUNDARIA DE LA CIUDAD DE BOGOTÁ

2009: Proyecto a la Secretaría de Educación
Marzo 8-13, 2010: Capacitación
CONGRESO DE NANOTECNOLOGÍA* (2-3 DE JULIO)

La manipulación de materia a escala menor de un micrón es una tendencia mundial que está explotando el SENA. Ya, de primera mano, los mayores avances en esta ciencia. Tras conferencistas internacionales.

**Viernes, 2 de Julio**

8:30 a.m. Instalación. Palabras de Jimena Díaz, Gerente Nacional de Tecn Academias Colombia y David Armer, Coordinador de Tecn Academias Cazuca.

9:00 a.m. La Nanofotónica y La Plasmónica. Conferencista: Hernando García

10:30 a.m. RECESO

11:00 a.m. Óptica Ultrarrápida -Aplicaciones a la nanoCieencia. Conferencista: Hernando García

12:30 p.m. ALMUERZO LIBRE

- Materiales Del Siglo XXI

3:30 p.m. RECESO

4:00 p.m. a) La Enseñanza de la nanoTecnología para el SENA. Estrategias - Guías - Profesores- Materiales de la nano
b) La Nanomedicina del Siglo XXI. Conferencista: Alfonso Lombana R.

**Sábado, 3 de Julio**

8:30 a.m. Los nanotubos y sus aplicaciones (parte I)

Los nanotubos son los elementos nano con más aplicaciones hoy en día. Conferencista: Wilfrido Moreno

10:00 a.m. RECESO

10:30 a.m. Los nanotubos y sus aplicaciones (parte II)

Conferencista: Wilfrido Moreno.

12:00 p.m. ALMUERZO LIBRE

- Aplicación de multicapas nanométricas para el mejoramiento de la productividad de las empresas.
- Conferencista: Jair Eugenio Niño

2:00 p.m. Conferencia a cargo del equipo de instructores de Tecn Academias Colombia. Acto de cierre. Palabras y agradecimientos.
Florida Advanced Technological Education for Manufacturing

A National Science Foundation Regional Center of Excellence

Marilyn Barger, Ph.D., P.E., CPT
Executive Director and P.I.
barger@fl-ate.org
www.fl-ate.org

FLATE
Florida’s Advanced Technological Education Center of Excellence

Impact Florida. Lead Nationally.
Hillsborough Community College
St. Petersburg College
USF College of Engineering
FLATE will be Florida’s leading resource for education and training expertise, leadership, projects, and services to promote and support the workforce in the high performance production and manufacturing community.

VISION

Impact locally. Lead nationally.
FLATE Goals & Objectives

Outreach • Curriculum Reform • Professional Development
Outreach & recruitment

- tours
- talks
- videos
- camps
- awards
- career paths
- lessons plans
- NEXT advertorial
- engineering Expo

www.madeinflorida.org
“Made in Florida” resources

www.madeinflorida.org

Manufacturing in Florida

...Good Jobs + Great Pay = GREAT LIFESTYLES!

Outreach & recruitment
Statewide K-14 career pathways
2 year degrees & college certificates
Statewide articulation agreements
Online resources & courses
Aligned to MSSC CPT & NAM
Stackable Credentials
Florida’s A.S. Engineering Technology Degree
60 semester hours

I. General Education – 15 - 18 credit hours
- English
- Science
- Math
- Social Science
- Humanities

II. ET Core - 18 credit hours
- Computer Aided Design
- Manufacturing Processes & Materials
- Mechanics & Instrumentation
- Electronics
- Quality
- Safety

III. 10 Specialization Tracts – 24 to 27 credit hours
- Advanced Manufacturing
- Biomedical Systems
- Electronics
- Quality
- Digital Manufacturing
- Advanced Technology
- Digital Design & Modeling
- Mechanical Design & Fabrication
- Alternative Energy Systems
- Industrial Energy Efficiency
A.S. Engineering Technology Pathways

Year 1

I. GENERAL EDUCATION COURSES
   (15 credit hours)
   - Computer Aided Drafting
   - Introduction to Electronics
   - Manufacturing Materials & Processes
   - Mechanical Measurements & Instrumentation
   - Quality
   - Safety

II. ENGINEERING TECHNOLOGY CORE
    (18 credit hours)
    - Articulate MSSC Certified Production Technician (CPT)
    - To 15 Credits of ET Core Courses

Year 2

III. ENGINEERING TECHNOLOGY SPECIALIZATION TRACTS
     (27 credit hours in 1 of 10 tracts)
     - Quality
     - Electronics
     - Advanced Technology
     - Advanced Manufacturing
     - Alternative Energy Systems
     - Biomedical Systems
     - Digital Design & Modeling
     - Digital Manufacturing
     - Industrial
     - Energy Efficiency
     - Mechanical Design & Fabrication

COLLEGE CREDIT CERTIFICATE
and/or
MSSC CERTIFIED PRODUCTION TECHNICIAN (CPT)

B.A.S. - Bachelor’s of Applied Science
OR
B.S.A.S. - Bachelor’s of Science in Applied Science
OR
B.S. E.T. - Bachelor’s of Science in Engineering Technology

LIFELONG LEARNING

CERTIFICATE PATHWAY
2-YEAR PATHWAY
2-YEAR PATHWAY STARTING WITH MSSC
FLATE’s Engineering Technology Network

Curriculum
# FLATE’s Engineering Technology Network

<table>
<thead>
<tr>
<th>SPECIALIZATION</th>
<th>COLLEGES &amp; LOCATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>College of Central Florida (CF) - Ocala Florida Gateway College (FGC) - Lake City St. Petersburg College (SPC) - Clearwater Tallahassee CC (TCC) - Tallahassee</td>
</tr>
<tr>
<td>Electronics</td>
<td>Eastern Florida SC (EFSC) - Cocoa, Palm Bay Broward College (BC) - Coconut Creek State College of Florida (SCF) - Venice St. Petersburg College (SPC) - St. Pete</td>
</tr>
<tr>
<td>Advanced Manufacturing</td>
<td>Florida Gateway College (FGC) - Lake City Florida State College (FSCJ) - Jacksonville Gulf Coast SC (GCSC) - Panama City Hillsborough CC (HCC) - Tampa Polk State College (PSC) - Lakeland Tallahassee CC (TCC) - Tallahassee</td>
</tr>
<tr>
<td>Mechanical Fabrication &amp; Design</td>
<td>Gulf Coast SC (GCSC) - Panama City Florida State College (FSCJ) - Jacksonville Northwest Florida SC (NWFSC) – Niceville Tallahassee CC (TCC) - Tallahassee</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPECIALIZATION</th>
<th>COLLEGES &amp; LOCATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Technology</td>
<td>Eastern Florida SC (EFSC) - Cocoa, Palm Bay Tallahassee CC (TCC) - Tallahassee</td>
</tr>
<tr>
<td>Biomedical Systems</td>
<td>Broward College (BC) - Coconut Creek St. Petersburg College (SPC) - Clearwater</td>
</tr>
<tr>
<td>Digital Design &amp; Modeling</td>
<td>College of Central Florida (CF) - Ocala Gulf Coast SC (GCSC) - Panama City Northwest Florida SC (NWFSC) – Niceville State College of Florida (SCF) - Venice St. Petersburg College (SPC) - St. Pete Tallahassee CC (TCC) - Tallahassee</td>
</tr>
<tr>
<td>Alternative Energy Systems</td>
<td>Eastern Florida SC (EFSC) - Cocoa, Palm Bay Broward College (BC) - Coconut Creek Gulf Coast SC (GCSC) - Panama City Tallahassee CC (TCC) - Tallahassee</td>
</tr>
<tr>
<td>Industrial Energy Efficiency</td>
<td>Florida State College (FSCJ) - Jacksonville</td>
</tr>
<tr>
<td>Digital Manufacturing</td>
<td>Gulf Coast SC (GCSC) - Panama City</td>
</tr>
</tbody>
</table>
Key Milestones 2008-2013

- ET Degree specializations
- ET Degree college credit certificates
- Colleges offering ET Degree

- Indicates the locations of colleges offering the ET Degree Program

<table>
<thead>
<tr>
<th>Year</th>
<th>ET Degree specializations</th>
<th>ET Degree college credit certificates</th>
<th>Colleges offering ET Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>5</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>6</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>2010</td>
<td>7</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>18</td>
<td>14</td>
</tr>
</tbody>
</table>

Enrollment:
- 2008-2009: 145
- 2009-2010: 347
- 2010-2011: 603
- 2011-2012: 703
Thank you!

Marilyn Barger, Ph.D., P.E., CPT
Executive Director and P.I.
barger@fl-ate.org

www.fl-ate.org
www.madeinflorida.com
www.flate.pbwiki.com
Honoring Diversity in Partnership with USF & HCC

“Female Electronic Engineering Student from Colombia will attend the Summer Camp”
Robótica Educativa

CAPÍTULO I

¿Qué aprenderemos hoy?

1.1 ¿QUÉ ES LA ELECTRÓNICA?

La electrónica es el campo de la ingeniería y de la física aplicado relativo al diseño y aplicación de dispositivos, normalmente circuitos electrónicos.


1.1.1. CIRCUITO ELECTRÓNICO

Es la interacción en un circuito cerrado de una fuente de energía (pila, batería o cargadores), y componentes electrónicos (resistencia), formando un circuito cerrado.

BATERIA

RESISTENCIA

Denota la cantidad de energía que recorre el circuito y se mide en Amperes (A).
Engineering Grand Challenges

- Make solar energy economical
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure
- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools of scientific discovery

Source: National Academy of Engineering
http://www.engineeringchallenges.org
Educación y Complejidad: una necesidad para afrontar los desafíos de la *Ciencia*, la Tecnología y la Innovación del siglo XXI

- Albert Einstein observed (1951):
  
  “One thing I have learned in a long life: that all our science, measured against reality, is primitive and childlike (uncomplicated) — and yet it is the most precious thing we have”

- Claude Lévi-Strauss (1964) - widely regarded as the father of modern anthropology,

  “The scientist is not a person who gives the right answers, he’s one who asks the right questions”
“The study of technology is itself a complex issue”

1. First, contrary to biological species technologies are not given in nature, but man-made constructs; they are the products of cultural evolution.

2. Technologies are continuously evolving/developing

3. Main perspectives in the study of technology:
   (a) Economics
   (b) The history of technology and the sociology of science
   (c) Science and Technology (S&T) policy analysis and R&D management.

“These three perspectives challenges us to consider technology as a subject of complexity studies”

Complexity and Technology by Loet Leydesdorff - Science & Technology Dynamics
University of Amsterdam, The Netherlands
A lot of research in complexity science is looking for ways to model, understand and extract the useful properties of biological systems. This is both with a view to better understanding of the biological systems and for inspiration for new approaches to solving technological and engineering challenges*

*Complexity Science Focus, http://www.complexity.ecs.soton.ac.uk/index.php
Biomimicry

Or biomimetics is the imitation of the models, systems, and elements of nature for the purpose of solving complex human problems.
Educación y Complejidad: una necesidad para afrontar los desafíos de la **Ciencia, la Tecnología y la Innovación** del siglo XXI.
Curriculum Development for Engineering Education, from a Complexity Perspective, to Meet the Challenges of the XXI Century
Luis Fernando Cruz Quiroga, Wilfrido Alejandro Moreno, Dulce García
WEEF 2012, Buenos Aires - Argentina

Abstract

The development of science and technology during the last fifteen years has shown new dimensions of reality. These new dimensions are characterized by complex interactions on the physical, quantum, biological, cognitive, social and ecological arenas, which enable new ways of producing information and knowledge. This paper proposes a framework for a new curricular development approach to meet the knowledge needs of the society of the XXI century, which is based on the paradigm of complexity. The proposed framework highlights the importance and the responsibility of engineering within the technoscientific and social context. It defines the role that the new engineer represents. It delineates the required skills and the new role that the university faculty member must play to facilitate meaningful learning. The framework is presently being evaluated for implementation within the Department of Electrical Engineering at the University of South Florida, (USF), Tampa, Florida, which maintains a close collaboration with the College of Education at the Universidad del Bosque, (UB), Bogotá, Colombia.
Figure 1. Curricular Structure for Engineering Programs from the Perspective of Complexity
Complex Systems of Systems Engineering: An Interdisciplinary Perspective

“Finding a Solution Space”

Electrical Engineering Graduate Course: Summer 2013
Definitions

• SE*: Systems Engineering is an interdisciplinary approach encompassing the entire technical effort to evolve and verify an integrated and total life cycle balanced set of system, people and process solutions that satisfy customer needs.

• SoSE: System-of-Systems Engineering is a set of developing processes, tools, and methods for designing, re-designing and deploying solutions to Systems-of-Systems challenges.
The SE “Vee”

“This is the most common structured SE approach used in at least 100 countries and in multiple disciplines”
Agile Methods and Scrum

• Agile Principles:
  1. Individuals and Interactions
  2. Deliverables
  3. Customer Collaboration
  4. Responding to Change

“Originally applied to SW development (with earliest application to hardware development)”

• Now Applied to SE
• Adaptive, Responsive, Evolving, Continuous Improvement
SoSE Modified VEE
ASoSE Remarks

➢ ASoSE is a must for all professionals

➢ SoSE education and training must start in college
  - Cross-disciplinary (EE, ME, CE, BioE, CS, etc.)
  - and Multi-disciplinary (Engineering, Business, Health Mgmt, Industrial, Environmental, IT, Cybersecurity, Human Factors, etc.)
THE UBIQUITOUS CONTROL SYSTEMS

“Trans/Multi/Inter-disciplinary by it’s Own Nature”

Aerospace

Robotics

Medical Simulators

CPS

Computers

Communications

Cyber

Physical

Instrumentation & Controls

Systems
Global Academic Trends in Interdisciplinary/Innovation Labs

OEDK@Rice

NI Student Project Center @ UT-Austin

Active Learning Plaza @ UniAndes, Bogotta - Colombia

ITLL@CU-Boulder
Innovation Plaza @ UNM
A MODEL TO PEDAGOGICALLY SUPPORT TEACHING & LEARNING SCENARIOS FOR ENGINEERING INNOVATION FROM A COMPLEXITY SCIENCES PERSPECTIVE
Luis Fernando Cruz Quiroga, Wilfrido Alejandro Moreno, Dulce García
WEEF 2013, Cartagena - Argentina

Abstract

Education for innovation requires innovation in education. To innovate in education implies new pedagogical models. It is not enough to just apply teaching/learning methods or strategies in a mechanical or procedural approach. It requires the conception of new pedagogical models based on theories that allow for processing of different interpretations of diverse complexity educational phenomena, i.e. other ways of producing and implementing pedagogical knowledge. Education in the different engineering programs has been carried out through analytical and linear processes; however the reality of education is given by complex systems characterized by uncertainty, chaos, breaks, nonlinearity and self-organization. To optimize curriculum processes that foster innovation in students, require strategies and teaching-learning scenarios that stimulate nonlinear processes and generate a change in the mindset of the professor and the student with new ways to understand and approach the reality of educating engineers. Making methodological adjustments without the understanding of the epistemological orientation that take into account complex dynamic processes will only generate pseudo-changes which limits the creativity and innovation processes. Currently, there are several global initiatives for the development of teaching-learning scenarios in order to facilitate innovation processes in engineering education and education for innovation. This paper is a proposal by the Complex Systems & Education Network (SCED-ISTEC) and the College of Engineering at the University of South Florida, of a model developed to pedagogically support innovation scenarios in educating engineers and educating for innovation using the sciences of complexity. The suggested scenarios are framed in a dynamic curriculum structure. They are characterized by hard and soft state-of-the-art technologies, interdisciplinary, flexible, pedagogical research processes, methodologies for cognitive restructuring, solving complex problems, modeling, simulation, interactions with university/industry programs and facilitating applications according to context and society needs.
The model is pedagogically based on the theory of Complex Systems. It is understood educational reality as a complex adaptive system characterized by multiple interactions between faculty, students, context, information etc. that generate collective patterns not attributable to its isolated components. These patterns are given in different levels or subsystems with non-linear dynamics and heterogeneous behavior characterized by ruptures, forks and uncertain emerging processes, change the order from the disorder and from the disorder is feedback and auto-organize.
LabVIEW: a Lifelong Engineering Tool

In Partnership with LEGO®

LEGO® MINDSTORMS® NXT
powered by LabVIEW

LEGO® WeDo®
powered by LabVIEW

Kindergarten - 12
Tech Schools/Community Colleges

University

Research

Industry

NI LabVIEW
NI LabVIEW
NI LabVIEW
NI LabVIEW
NI LabVIEW
NI cRIO
NI PXI
NI myDAQ™
NI ELVIS™
NI cDAQ
NI USRP2

NATIONAL INSTRUMENTS™
InterDisciplinary Learning Lab (IDLL) @ The College of Engineering - USF

- A common facility has been created in order to enhance inter/multi/transdisciplinary collaboration among engineering graduate, undergraduate students, and faculty across our six engineering departments.

- This common area, will also welcome students who participate in our College’s Research Experience for Undergraduates program as well as engineering freshmen in our first year Engineering course.
**InterDisiplinary Learning Lab (IDLL) @ The College of Engineering - USF**

- The IDLL serves as a showcase Learning Center situated on the first floor of the main USF Engineering building.

- The IDLL space is organized into separate “pods” that are designed to support hands-on experimentation in multiple areas of engineering.
Research Complex Systems
Exploring Sciences with NAO

MOVING
- Mapping
- Planning
- Navigation
- Localization

INTERACTING
- Psychology
- Healthcare
- Social Robotics

CONTROLLING
- Control
- Whole Body Motion
- Manipulation grasping
NAO Applications - Health

“It’s the first robot to help children manage painful medical procedures”

Study, which was conducted at Alberta Children’s Hospital. Research suggests that children who experience distress in a medical setting at a young age are less likely to access health care in adulthood,
Studies have shown that some children with autism achieved a 30 percent increase in social interactions and better verbal communication when a robot is in the same room.
Research Complex Systems
Ibero-American Nanotechnology Centers Network (IBANCN)

- Faculty/Student Exchange
- Educational Initiatives
- Research Collaborations
- Community Engagement
- Technical Support
- Equipment & Supplies Acquisitions
Cyber-Physical Systems

Embedded Systems

Automation & Control/Robotics

XILINX®

SilTERRA

QUANSER

NATIONAL INSTRUMENTS™
Major Digital Changes

#1: MOBILE
(mHealth, apps, self-care, remote monitoring…)

@gkeflannan - "6 digital trends changing health care in 2012...and beyond"
FITBIT Tracker

Digital Health: Mobile

Fitbit Tracker, wireless-enabled wearable data measuring device
Skin Scan applications
Head set EEG hack

Digital Health: Mobile

Nokia N900 and Emotiv EPOC neuro headset EEG hack

@gkoflannan - "6 digital trends changing health care in 2012...and beyond"
Vision for Future Pharmacy practice

➢ “Pharmacists will be the health care professionals responsible for providing patient care that ensures optimal medication therapy outcomes” and “Pharmacists will have the authority to manage medication therapy and will be accountable for patients’ therapeutic outcomes.”

➢ Vision foreseen by Joint Commission of Pharmacy Practitioners.

Changing face of Pharmacy Profession and Practice in USA

As noted by Dr. Dennis Helling upon receiving the 2013 Remington Honor Medal,

“If you don’t like change, you will like irrelevance even less.”

Helling DR. 2013 Remington Honor Medal Address.
Pharmacogenomics: leading to personalized medicines

In pharmacogenomics, genomic information is used to study individual responses to drugs.

Genetic variability leading to susceptibility to adverse drug reactions can affect both pharmacokinetic and pharmacodynamic pathways.
How College of Pharmacy at USF is Different and addressing these challenges

- Empowered by innovation
Cyber Security @ USF
USF CAMLS

“A one stop shop for the medical device industry”
Surgical and Interventional Training Center

Where surgeons, interventionalists, and residents apply and practice procedures using state-of-the-art technologies
“Son tiempos de grandes oportunidades y optimismo puesto que la aplicación de las nuevas tecnologías emergentes no sólo tienen la capacidad de mejorar la calidad de vida, pero también permiten la creación y el florecimiento de nuevas comunidades y instituciones sociales mejor preparadas para afrontar las necesidades de nuestra sociedad"
United Nation’s definition of Sustainable Development:

El desarrollo sustentable es el desarrollo que satisface las necesidades del presente sin comprometer la capacidad de las generaciones futuras para satisfacer sus propias necesidades.
Innovación ....

“En realidad la mayoría de innovaciones son creadas a través de REDES – grupos de personas trabajando en “concordancia”

Dr. Andrew B. Hargadon
Professor of Management
Director, Technology Management Programs
Faculty Director, UC Davis Center for Entrepreneurship
“Teaching the right skills to aspiring scientists and engineers is important, but arming all students with STEM know-how is critical for the jobs of the future”

Dr. Charles Vest
President emeritus of the National Academy of Engineering and the Massachusetts Institute of Technology.
Leadership has no alternative: let us learn to take the challenges of forthcoming changing scenario

Leadership is solving problems.

The day soldiers stop bringing you their problems is the day you have stopped leading them.

They have either lost confidence that you can help or concluded you do not care. Either case is a failure of leadership.

Colin Powell
Muchas Gracias ..........
wmoreno@usf.edu
www.usf.edu
References

- **FEDERAL SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) EDUCATION 5-YEAR STRATEGIC PLAN, A Report From The Committee On STEM Education National Science And Technology Council – May 2013**


- Members of the FC-STEM are listed on p. iii

- Members of CoSTEM are listed on page iv. The same agencies were represented on the FI-STEM.


- STEM fields are defined in the National Science Foundation’s Science and Engineering Indicators, [http://www.nsf.gov/statistics](http://www.nsf.gov/statistics)

- **PCAST President’s Council of Advisors on Science and Technology. (February 2012). Report to the President: Engage to excel: Producing one-million additional college graduates with degrees in science, technology, engineering, and mathematics.** [http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excelfinal_2-25-12.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excelfinal_2-25-12.pdf)


References

- This fifth priority, focused on the STEM workforce, was discussed in CoSTEM and was not specified as a goal in the progress report of February 2012. It has been recast as a goal in light of the President’s FY 2014 STEM education reorganization. It has since been added in the development of this final report.
- PCAST President’s Council of Advisors on Science and Technology. (February 2012). Report to the President: Engage to excel: Producing one-million additional college graduates with degrees in science, technology,
References

- Increasing the Achievement and Presence of Under-Represented Minorities in STEM Fields
- NSTC_Education_Report_Complete.pdf
- iihttp://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2010028 and
- ivhttp://www3.northern.edu/rc/pages/reading_clinic/highschool_graduation.pdf
- vhttp://cshe.berkeley.edu/publications/docs/ROP.Geiser.4.04.pdf and
- http://www.nc4ea.org/files/relationship_between_ap_and_college_graduation_02-09-06.pdf
- vihttp://nber.org/papers/w19165
- viihttp://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf
Dedicado a ....