# EXAMINING COMPETITIVENESS THROUGH SCIENCE, TECHNOLOGY, ENGINEERING AND MATH

## FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON HIGHER EDUCATION, LIFELONG LEARNING, AND COMPETITIVENESS

COMMITTEE ON EDUCATION AND LABOR

U.S. HOUSE OF REPRESENTATIVES

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# C O N T E N T S


| | Page |
|---|---|
| Hearing held on September 21, 2007 | 1 |
| Statement of Members: | |
| Hinojosa, Hon. Rubén, Chairman, Subcommittee on Higher Education, Lifelong Learning, and Competitiveness | 1 |
| Prepared statement of Frank Reyes, government relations officer, San Bernardino Community College District | 2 |
| Statement of Witnesses: | |
| Baker, Warren J., president, California Polytechnic State University | 12 |
| Prepared statement of | 14 |
| Drummond, Marshall E., chancellor, Los Angeles Community College District | 27 |
| Prepared statement of | 29 |
| Hackwood, Susan, executive director, California Council on Science and Technology | 34 |
| Prepared statement of | 36 |
| Reed, Charles B., chancellor, California State University System | 5 |
| Prepared statement of | 7 |
| Tarantino, Dr. Frederick A., president and CEO, Universities Space Research Association | 19 |
| Prepared statement of | 21 |
| Ullah, Todd, Ed.D., director of science, Los Angeles Unified School District | 30 |
| Prepared statement of | 32 |

# EXAMINING COMPETITIVENESS THROUGH SCIENCE, TECHNOLOGY, ENGINEERING AND MATH

**Friday, September 21, 2007**
**U.S. House of Representatives**
**Subcommittee on Higher Education, Lifelong Learning, and Competitiveness**
**Committee on Education and Labor**
**Washington, DC**

The subcommittee met, pursuant to call, at 9:30 a.m., at the Kellogg West Conference Center on the campus of California State Polytechnic University, 3801 West Temple Avenue, Pomona, California 91768, Hon. Rubén Hinojosa, [chairman of the subcommittee] presiding.

Present: Representatives Hinojosa and Hirono.

Also Present: Representatives Baca and Napolitano.

Staff Present: Ricardo Martinez, Policy Advisor for the Subcommittee on Higher Education, Lifelong Learning and Competitiveness.

Chairman HINOJOSA. We are going to get started, and I am going to call this meeting to order.

A quorum is present. The hearing of the subcommittee will come to order.

Before we begin, I would like to thank Ms. Mazie Hirono for traveling across the country to participate in this hearing. I appreciate all your contributions that you have made to the subcommittee's work and look forward to this hearing that we're having here in California.

Also, I would like to ask unanimous consent to invite two of our colleagues who are not committee members to join us on the dias. Congresswoman Grace Napolitano and Congressman Joe Baca, the former chair, and the current chair of the CHC, who have long-lasting interests in advancing America's competitiveness in the STEM fields.

Without objection, so ordered.

Pursuant to the committee rule 12A, any Member may submit an opening statement, in writing, which will be made part of the permanent record of today's hearing.

Without objection, all members will have 14 days to submit additional materials or questions for the hearing record.

[The information follows:]

[Additional statement submitted by Mr. Hinojosa follows:]

**Prepared Statement of Frank Reyes, Government Relations Officer, San Bernardino Community College District**

Good Morning, Chairman Hinojosa and Ranking Member Keller.

My name is Frank Reyes, Government Relations Officer for the San Bernardino Community College District of California.

I am honored to be here today representing my college as well as the Hispanic Association of Colleges and Universities (HACU), where I serve as a member of the HACU Government Relations Committee and a member of the Department of Defense/HACU Leadership Group. My institution has been a member of HACU for many years and has a strong record of advocating for increased educational opportunity, achievement and success for Hispanics and other students that attend the more than 270 Hispanic-Serving Institutions.

The Hispanic Association of Colleges and Universities and the more than 400 U.S. colleges and universities it represents (including the nation's Hispanic-Serving Institutions or HSIs) deeply appreciate all the work which you have dedicated to the improvement of Hispanic education and success. We even more appreciate your decision to explore through this public hearing the participation of Hispanics and other students in our higher education system in the science, technology, engineering and mathematics (STEM) areas of study, research and career preparation.

I want to let you know that HACU is deeply concerned that more Hispanics are not selecting STEM fields to prepare for careers in these areas vital to the nation's future.

While Hispanics represent the fastest growing population group today and demographers project that this population will account for more than 60 percent of the school-age population growth in the next decade, today, Hispanics continue to be grossly underrepresented in STEM areas. The Division of Science Resources Studies of the National Science Foundation (NSF), for example, reports that Hispanics earn only 2.8 percent of doctorates in science and engineering, compared to 51.4 percent earned by non-Hispanic whites.

The National Center for Educational Statistics (NCES) reports that for the 2003-2004 academic year, only 104 Hispanic students earned doctorate degrees in engineering (out of 5,923 degrees awarded) and only 25 earned a doctorate in mathematics and statistics (out of 1,060). At the master's level, NCES reports that only 114 Hispanics students out of 4,191 earned a master's degree in mathematics and statistics and only 139 Hispanic students out of 5,570 earned a master's degree in physical sciences and technology for the same academic year.

It is this stark reality that motivates HACU to look to the National Science Foundation as the premier federal agency to address the shortage of Hispanics in STEM areas by investing greater resources and forming new collaborations with Hispanic-Serving Institutions to increase the quantity and quality of undergraduate and graduate STEM programs and research. By increasing the number of STEM programs at HSIs, NSF will assist the nation in preparing the STEM professionals so necessary for the economic future of the nation. To not do so, will place the United States in a precarious position where the nation will become more dependent on STEM experts from other countries such as China and India.

Cognizant of this fact and the knowledge that HSIs can play a vital role in assisting the nation in maintaining its preeminence of innovation in the sciences, mathematics, engineering and advanced technologies, HACU developed a blueprint for higher education success in the STEM areas and submitted this document to Congress for inclusion in the National Science Foundation Reauthorization. "HACU's Public Policy Priorities for the 2007 Reauthorization of the National Science Foundation" calls for greater attention to the education and training of a new contingent of experts in STEM areas to meet the workforce development needs of the nation.

It is HACU's conviction that the STEM workforce needs can be met by engaging Hispanic-Serving Institutions in the process. HSIs are poised to contribute to the rebirth of STEM study in our schools, colleges and universities. Information from the College Board and the National Center for Education Statistics shows that 111 HSI community colleges and 92 four year postsecondary institutions offer associate, baccalaureate and graduate programs and degrees in the STEM areas. HSIs are prepared for the challenge of meeting the nation's STEM needs, but are hampered by under funding from those federal agencies that most provide STEM resources.

HACU has also included this concern in the "HACU Public Policy Priorities for the 2007 Reauthorization of the Elementary and Secondary Education Act of 1965 (ESEA). HACU has identified 1600 Hispanic Serving School Districts HSSDs schools that have an enrollment of 25% or more Hispanic students) tend to be located in

district with limited resources. Many of math and science teachers lack current advanced education in the STEM areas thereby making it difficult to provide Advanced Placement Courses for students capable of higher level STEM study.

Without access to AP courses Hispanic students will be limited in academic competency in STEM related courses thereby making it more difficult to be accepted in colleges and universities as well as to begin more advanced STEM courses for those who wish to major in STEM related disciplines. In fact, the Digest of Educational Statistics for 2006 reports that in 2005, 10% of all White students were enrolled in A.P. calculus compared to 5.0 % for Hispanic students, a 50% difference with a similar statistical gap existing in the AP honor biology programs with 17.0% of White students enrolled but only 11.8% Hispanics. In Advanced Placement Honors Physics, 5.6% of White students were enrolled in comparison to only 3.4% for Hispanics. As a consequence, HACU has identified this challenge by incorporating STEM competency in HSSDs as a partnership goal for HSIs and HSSDs which could be accomplished by replicating a successful HACU-NASA pre-collegiate STEM program for middle and high school students

Overall, HACU strongly recommends greater federal attention to STEM workforce development at all levels of the educational process beginning at the elementary, middle, and high school levels, to prepare students for STEM success at the postsecondary education. Only by developing a STEM pipeline through all levels of education will we experience an increase in interest and enrollment of students in STEM areas of study and an increase in number and quality of STEM teachers, professors and professionals for the national security and economic needs of the nation.

Chairman Hinojosa, I want to thank you for the opportunity to present these written remarks to you and your committee. HACU remains fully committed to assist you and your committee to assure that the nation remains the world leader in science, technology, engineering and mathematics.

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Chairman HINOJOSA. I would like to at this time introduce our very distinguished panel of witnesses here with us today, this morning. The first one will be Dr. Charles Reed. He is our first witness today. He serves as chancellor of the California State University and is chief executive officer of the country's largest senior system of public higher ed. He provides leadership to 46,000 faculty and staff, and 417,000 students on 23 campuses, and seven off-campus centers.

The CSU, which spans the entire State of California, has an annual budget of more than $5 billion. He has served in a similar position in Florida, has a long and honorable history of professional contributions in higher education and public service.

He has appeared before our full committee, and a subcommittee in Washington before, and it is a pleasure to welcome you again.

The second panelist will be Dr. Warren Baker. He is our second witness, and has served as president of California Polytechnic State University in San Luis Obispo, California, since 1979. He is a former member of the presidential appointee of the National Science Board, where he chaired the board's Polar Research Committee.

In addition, he serves on the board of directors of the National Association of Universities and Land Grant Colleges, and serves as presidential appointee on the board of International Food and Agricultural Development for the United States Agency for International Development.

Dr. Baker has earned civil engineering degrees from Notre Dame, and his PhD in geothermal engineering from the University of New Mexico. Welcome.

Dr. Frederick Tarantino is the third presenter and is one of our neighbors in the Washington Metropolitan area. He holds a BS in

physics from—I can't even pronounce the name of your institute here—Rennsalear Polytechnic Institute.

He received his master's of science in nuclear sciences from the Air Force Institute of Technology and his PhD in nuclear reactor physics from MIT.

In addition, he is also a graduate of the Wharton Business School's Advanced Management Program. During his 19 year career in the U.S. Army, he held many important posts and later worked in the White House on science and technology issues.

He has also worked for the Bechtel Corporation in the private sector. We welcome you.

Dr. Marshall Drummond is next, and he began working as chancellor of the Los Angeles Community College District since July 2007. LACCD is the largest community college district in the Nation, and it includes nine colleges with an annual budget of nearly $1 billion, serving approximately 180,000 students.

Prior to his current position, he was the chancellor of the California Community Colleges, and in that position, he was responsible for providing leadership to 72 community colleges, districts, statewide. He served as LACCD president for five years prior to his statewide appointment and has been a professor at various higher education institutions, and has also served in the private sector with the Systems and Computer Technology Corporation.

He holds two degrees in science, science management, economics, and business from San Jose State University, and his doctorate in education from the University of San Francisco. Welcome.

The fifth presenter will be Dr. Todd Ullah, who is currently the director of Secondary Science, overseeing all curriculum guide development, professional development, technology, science facilities development, and science grants for the Los Angeles Unified School District.

He is a five year member of the 11 Region Coordinating Council for the California Technology Assistance Project and the Statewide Educational Technology Services Program. He has over ten years of teaching biological and physical sciences in high schools, including special work with charter schools.

Todd holds a bachelor's of science as well as master's of science in biological sciences. Thank you, Todd, for joining us and for providing your leadership and professional experience on behalf of our younger students.

Also with us is a very important panelist who I chose, Dr. Susan Hackwood, Executive Director of the California Council on Science and Technology. She is our final witness. She is professor of electrical engineering at the University of California-Riverside, and visiting associate in engineering at the California Institute of Technology.

The CCST is a not-for-profit corporation comprised of 150 science and technology leaders sponsored by the key academic and federal research institutions in California. The organization advises the state on all aspects of science and technology, including stem cell research, intellectual property, energy, information technology, and biotechnology, and in education.

Dr. Hackwood received a PhD in solid state bionics in 1979 from the De Montfort University in the United Kingdom. She was the

founding dean of the Bourns College of Engineering at UC-Riverside, and is responsible for all research and teaching aspects of five PhD-level programs.

She has published over 140 technical publications and holds seven U.S. patents. Susan is very active, professionally, at the national and international levels, but she managed he schedule to be with us today. Welcome. We're honored to have you.

For those of you who have not testified before this subcommittee, let me briefly explain our lighting system and the five minute rule. Everyone, including members, will be limited to five minutes of presentation of questioning of the presenters. The green light is illuminated when you begin to speak. When you see the yellow light, it means you have one minute remaining. When you see the red light, it means your time has expired and you need to begin conclusion of your testimony.

Please be certain as you testified to turn on the switch and speak into the microphone in front of you, so we can get the taping and put it into the record.

We will now hear from our first witness.

Dr. Reed.

**STATEMENT OF DR. CHARLES B. REED, CHANCELLOR, CALIFORNIA STATE UNIVERSITY**

Dr. REED. Thank you, Chairman Hinojosa, and members of the subcommittee, for inviting us to talk about the critical and daunting issues facing California and this entire country.

Number one is having students prepared for this country's future workforce. Number two is alleviating the shortage of qualified teachers in the science, technology, engineering and mathematic areas, so that students get that needed preparation, especially our underserved students.

In an article that I authored for the November issue of Change magazine, I was asked to talk about the greatest challenge facing me as chancellor of the California State University. I believe it is the urgent need to reach students from traditionally underserved populations, to prepare them for college, get them into college, and to make sure that they graduate into meaningful jobs in this country's workforce.

They constitute the majority of students in the 23 campuses of the California State University, and soon, other states in this country will experience this rise in the number of students of color.

That ties in with what we are talking about today. We must educate our students better, and to do that, we need teachers who are trained in the subjects that they teach.

I have said for many, many years, that the key to student learning is having a good, qualified teacher. There is no higher priority. If a student has a high-performing teacher, they will learn.

The California State University prepares about 60 percent, or over 13,000 of California's teachers each year. Producing high quality math and science teachers is a board of trustees policy.

We requested and received this year, a state budget augmentation of over $2 million to support our commitment to doubling the number of teachers that we prepare in these fields. Our commitment to producing these teachers consists of a several part action

plan which is detailed in my written testimony that we have provided you.

Through this plan, we've increased math and science teachers by 37.6 percent in the last two years.

We've increased our preparation of math teachers 64 percent, responding to the crisis in California in which we have over 70,000 middle school students, mostly from minority and low-income homes, that have algebra teachers who are not prepared to teach algebra.

Production of chemistry and physics teachers in the CSU fields, with severe shortages, has expanded 42 percent. This too is essential. Currently, nearly one-third of the physical science teachers are underprepared in California.

Key elements of our plan that have led to the increases include recruitment initiatives, new teacher credential pathways, Web-supported instructional materials, better collaboration with community colleges, financial support for teacher candidates, and thank you for what you did for Pell and for the new teachers for the inner cities, and especially our focus on underserved populations. And lastly, partnering with federal labs in business and industry.

President Baker from our Cal Poly campus will talk to you, in a little more detail, about our initiatives with the national labs.

Please also see the addendum on Cal State Fullerton's initiative on STEM programs, which it has quadrupled the number of math teachers is prepares, and one reason it was chosen as a national case study.

Now, in addition to what we are doing in teacher preparation, the CSU is absolutely committed to reaching out to the state's diverse communities and providing access to college that will translate into successful entry into the state's workforce. I'll mention just a few programs, and they're all referred in my written testimony.

The CSU works closely with the Hispanic Association of Colleges and Universities to recruit and retain Latino students. Twenty-six percent of our 420,000 students are Latino. We also work with the Parent Institute for Quality Education, PIQE, to get Latino parents, especially mothers, involved in their children's education, and help them navigate the college admission and financial Agency for International Development area. We graduated 7,700 Latinos this last year in our PIQE program.

We have given out, this last year, 1.3 million of these posters to students throughout California, and this poster tells you how to go to college. How to apply, how to get financial aid, how to get federal financial aid.

More recently, we've expanded our partnership with HENAC, the Hispanic Engineering National Achievement Corporation. Their office is across the street from Cal State University Los Angeles, which is across the freeway from East Los Angeles. HENAC has been approved by the Department of Defense for a five year, $10 million program, called Value Chain Project.

The Value Chain Project is targeted at producing Latino engineers and having Latino engineering mentors as role models in the classroom. They've adopted 13 elementary schools that feed into

three middle schools, which feed into one high school. The project starts with 4th graders. That's the right place to start.

We also have to support your Gear Up, TRIO, and Upward Bound programs. The California State University is the largest beneficiary of Gear Up, TRIO, and Upward Bound.

This past year, the CSU instituted a systemwide professional science master's program, that offers innovative master's degrees, which prepares students to develop the science, technology and management skills needed for today's workforce.

Many of these students are underrepresented minority students. We institute an early assessment program where the California State University offers a test to every 11th grader in California.

This year, we tested more than 340,000 students, some 450,000 in English and in mathematics, and we gave them an early "heads up" as to whether they are prepared to go to college or not.

One of the big things in this country that we need to do, is to align our expectations in universities with high school curriculum. And so we're trying to do that.

Once our students enter one of our 23 campuses, they get involved in many programs to excel in the STEM fields. For instance, our minority access to research careers, our minority biomedical research support programs, help these students. One measure of our success is that the National Science Foundation has identified the California State University as top baccalaureate-producing program for students who get doctor's degrees in science.

Five of the CSU campuses are among the top 50 institution in the United States in producing Hispanic doctoral recipients.

Chairman HINOJOSA. I ask you to please bring it to conclusion.

Dr. REED. I have given you many numbers. I want to leave you with what the California State University is more about than just the numbers. It's about success. It's about paying attention. When I say "paying attention," we care about our underserved students. We want to go out and get those students to attend the CSU. We want to help them not only get access but to graduate and to enter the workforce in this country. Thank you very much.

[The statement of Dr. Reed follows:]

**Prepared Statement of Charles B. Reed, Chancellor, California State University System**

Chairman Hinojosa and members of the Sub-Committee, thank you for inviting me to discuss the commitment of the California State University (CSU) to ensuring that all students in California are equipped to enter the workforce well-prepared and that the needs for skilled professionals are met in fields that are central to the state's economic competitiveness. I will focus my comments on the critically needed foundation for preparation in the science, technology, engineering and mathematics (STEM) fields, with particular attention to increasing the participation of underrepresented students in these fields. The most basic foundation for any advances in STEM fields is having sufficient numbers of well-qualified mathematics and science teachers, and I will describe the CSU commitment to doubling teachers in these fields—a major systemwide priority.

*The California State University: Context*

Few, if any, university systems match the scope of the CSU system. It is the largest four-year university system in the country, with 23 campuses, approximately 450,000 students and 46,000 faculty and staff. The CSU mission is to provide high-quality, affordable education to meet the ever-changing needs of the people of California. Since the system's creation in 1961, it has awarded approximately 2 million

degrees. The CSU currently awards approximately 92,000 degrees and 13,000 teacher credentials each year.

The CSU plays a critical role in preparing California's youth for the job market. Our graduates help drive California's aerospace, healthcare, entertainment, information technology, biomedical, international trade, education, and multimedia industries. The CSU confers 65 percent of California's bachelor's degrees in business, 52 percent of its bachelor's degrees in agricultural business and agricultural engineering, and 45 percent of its bachelor's degrees in computer and electronic engineering. The CSU also educates the professionals needed to lead and serve in the state's major institutions. It provides bachelor's degrees to teachers and education staff (87 percent), criminal justice workers (89 percent), social workers (87 percent) and public administrators (82 percent). Altogether, about half the bachelor's degrees and a third of the master's degrees awarded each year in California are from the CSU.

One key feature of the CSU is its affordability. For 2007-08, the CSU systemwide fee for full-time undergraduate students is $2,772. With individual campus fees added, the CSU total fees average $3,450, which is the lowest among any of the comparison public institutions nationwide.

Close to sixty percent of the teachers credentialed in California (and ten percent of the nation's teachers) each year are prepared by the CSU. High quality teacher preparation is one of the top priorities of the system and the CSU Board of Trustees. In 2005, the system made the preparation of additional science and mathematics teachers one of its foremost goals. Reflecting this commitment, the CSU system requested and received in the 2007-08 state budget a permanent augmentation of $2 million to support this major commitment on an ongoing basis.

*Maintaining California's Competitiveness: Mathematics and Science Teacher Preparation*

Rising Above the Gathering Storm,[1] the widely respected report issued by the National Academies of Science and Engineering in 2006, underscored the centrality of the mathematics and science teaching force in securing the nation's economic future. In its recommendations, the report placed the highest priority on recruitment and preparation of outstanding candidates for teaching in these fields. It emphasized that the US system of public education is the foundation for a workforce that is proficient in mathematics and science, fields critical to the nation's economic survival, and that the most critical resource, and the one in increasingly short supply, is excellent teachers in these fields.

Two and a half years ago, I made the commitment to double the number of mathematics and science teachers prepared by the CSU by 2009-10. This meant increasing from a baseline figure of approximately 750 new mathematics and science teachers produced each year to preparation of 1,500 new teachers in these fields annually. Since that time, our Mathematics and Science Teacher Initiative (MSTI)[2] has increased production of teachers in these disciplines by 37.6%.

We have increased production of mathematics teachers by more than 60%, responding to significant needs in California: 35% of current middle school teachers assigned to teach Algebra 1 do not have a mathematics credential. Approximately 69,000 middle school students are enrolled in Algebra 1 classes where the teacher is under-prepared or teaching out-of-field. Students in schools that are predominantly minority are four times as likely to have under-prepared mathematics and science teachers as students in schools with few minority students.

Production of chemistry and physics teachers—fields with severe shortages—has expanded by 42%. This, too, is essential. Currently, nearly one-third of physical science teachers are either under-prepared or assigned out-of-field, and under-represented students are taught by the least qualified teachers in these fields.

The CSU has brought together the leadership of its undergraduate programs in mathematics and science and its teacher education programs to address severe teacher shortages in these fields. In 2005, CSU awarded 651 math, 1,930 biological sciences, and 516 physical sciences (chemistry, geosciences, and physics) undergraduate degrees. Although these are only some of the fields that lead to teaching credentials in mathematics and science, the figures provide an indication of the CSU institutional capacity that is and will continue to be built upon to prepare the mathematics and science teachers the state needs.

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[1] National Academies of Sciences and Engineering. (2006). Rising Above the Gathering Storm: Energizing and Employing American for a Brighter Economic Future. Washington, DC: National Academy Press.

[2] See *http:///www.calstate.edu/teachered/MSTI.*

*Components of the CSU Mathematics and Science Teacher Initiative*

The CSU Math and Science Teacher Initiative began in 2004-05 through a planning process involving all of its 22 campuses that prepare teachers. A seven-part action plan was developed that is focused on doubling mathematics and science credential production through multiple strategies.

*Component #1. Comprehensive Recruitment Aimed at Expanding and Diversifying the Pool of Candidates*

Objective: To significantly expand recruitment of new mathematics and science teacher candidates

Programs: Comprehensive, sustained, and innovative recruitment and marketing initiatives

The first component of the CSU action plan is directed toward substantially expanding and diversifying the pool of qualified candidates entering mathematics and science teaching. It is a broadly-based recruitment effort targeted to college students and recent graduates, community college and high school students, mid-career and pre-retirement professionals, recent retirees, and teachers with the potential to change fields.

*Component #2. Creation of New Credential Pathways*

Objective: To establish multiple new pathways to mathematics and science teaching credentials

Programs: A broad range of new programs beginning at the freshman level and continuing through fast-track post-baccalaureate options

A central part of the CSU strategy to expand mathematics and science teacher production is the creation of new credential pathways. The purpose is to establish multiple points of entry into these fields for individuals at different educational and career stages. New pathways include, for example, (1) blended programs for undergraduates in which an academic major and teacher preparation are integrated in an articulated program of study, and (2) a new Foundational Level mathematics credential for middle school teachers accessible to candidates earning a multiple subject credential for grades K-8 as well as a single subject credential for secondary grades.

*Component #3. Internet-Supported Delivery of Instruction*

Objective: To create systemwide Internet-supported mathematics and science credential preparation resources

Program: New online-supported teacher preparation programs in mathematics and science

To accommodate the needs of diverse pools of candidates, flexible preparation options are needed that allow for online learning. The CSU initiative includes development of Internet-supported instruction both for preparation to pass required California Subject Examination for Teachers (CSET) tests and to make academic course work available online.

*Component #4. Collaboration with Community Colleges*

Objective: To implement integrated 2-year/4-year mathematics and science credential preparation programs with California's community colleges

Programs: Partnerships with community colleges that align lower division and upper division mathematics and science teacher preparation and institutionalize early recruitment and academic advising for teaching careers in these fields

A central component of the CSU approach is collaboration with community colleges in integrated 2-year to 4-year programs that provide an articulated and continuous sequence of preparation for mathematics and science teaching. The Chancellor's Offices of the CSU and of the California Community College System have entered into a Memorandum of Understanding (MOU) that advances system-level strategies to institutionalize articulated pathways.

*Component #5. Financial Support and Incentives*

Objective: To provide financial support for new mathematics and science teachers through the full array of available fiscal resources

Programs: Scholarships, loan assumption programs, paid tutoring, service learning, school district internships

An important component of CSU's strategy—one essential for its success—is providing support for candidates through scholarships and loan assumption/cancellation programs, paid tutoring, and internship opportunities that make teacher preparation financially attainable and attractive for college students of all backgrounds. This is particularly important because significantly increasing participation from

underrepresented groups, those most often in need of financial assistance, is a central component of CSU's strategy.

A major effort has been undertaken by CSU in collaboration with the California Student Aid Commission to foster maximum utilization of California's Assumption Program of Loans for Education (APLE). This important state program for future teachers provides up to $19,000 of loan forgiveness for new mathematics and science teachers. CSU campuses have awarded loan cancellation awards to more than 6,000 teacher education students in the past year, enabling them to enter the teaching profession in shortage fields with little or no debt.

The federal Noyce Scholarship program is another important source of financial aid. Twelve CSU campuses have received competitive grants from the National Science Foundation, averaging over $400,000 each, to implement Noyce scholarship programs. These funds have enabled them to provide scholarships of $10,000 per year for up to two years for future mathematics and science teachers—both upper division undergraduates and teacher credential candidates in these fields.[3]

Paid tutoring is another important vehicle providing financial support and recruitment benefits. Research shows that the desire to assist others is a primary factor in recruitment into mathematics and science teaching and that the opportunity to do so enhances the quality of new teacher preparation in these fields. At CSU campuses like San Diego State University, community college students interested in mathematics or science teaching serve as paid tutors for 20 hours a week. They work with students from nearby school districts that serve predominantly minority students with the goal of increasing their preparation and participation in post-secondary education.

*Component #6: Identifying and Scaling-Up Approaches Having Significant Potential*

Objective: To identify and scale-up cost-effective mathematics and science teacher recruitment and preparation approaches

Programs: Expanding approaches that have been demonstrated to be effective

The CSU strategy is a carefully planned one aimed at identifying, analyzing, and scaling up especially promising and cost-effective approaches for preparing highly qualified mathematics and science teachers. Examples of strategies identified for scale-up to-date include aligned programs of preparation with community colleges, online preparation for the California Subject Examination for Teachers (CSET), and programs in which undergraduates provide lab-based science activities for local students from low-income and minority schools.

*Component #7. Partnerships with Federal Laboratories, Business and Industry*

Objective: To establish and institutionalize partnerships that enhance the attractiveness of teaching careers in mathematics and science

Programs: Partnerships with federal laboratories, business and industry enriching mathematics and science teachers' career opportunities

Long-term success in increasing recruitment, preparation, and retention of mathematics and science teachers requires career opportunities that encourage the brightest STEM majors to enter and remain in teaching careers. Engaging in science research at federal laboratories and/or industry sites can re-invent and revitalize mathematics and science teaching and significantly enhance the attractiveness of careers in these fields.

Consistent with the recommendations of the Business Higher Education Forum in An American Imperative,[4] the report that reflects the results of a major project co-chaired by President Warren Baker, the CSU has begun an initiative with Lawrence Livermore National Laboratory aimed at enabling outstanding science undergraduates interested in becoming teaching candidates to work at the Lab on a paid basis during the summer. This type of program, which increases the quality of science teacher preparation and the interest of science majors in teaching careers, is especially promising, and we urge greater federal support for these types of programs for future teachers at federal laboratories.

*CSU STEM Activities Focused on College Access and Preparation*

Strengthening the K-12 pipeline by increasing the numbers of well-qualified mathematics and science teachers is one critical underpinning of improving Califor-

[3] Under the America COMPETES Act, total funding for Noyce scholarships through NSF is authorized to increase significantly, and the period during which candidates can receive $10,000 scholarships is extended to three years.

[4] Business Higher Education Forum. (2007). An American Imperative: Transforming the Recruitment, Retention, and Renewal of our Nation's mathematics and Science Teaching Workforce. Washington, D.C.: BHEF.

nia's competitiveness. The CSU is also engaged in a broad range of activities focused on enhancing college access and academic preparation for California's diverse population that contribute in significant ways to preparing the workforce that is critical to the state's economic prosperity. For example:

• The CSU is deeply engaged in efforts to ensure college access for diverse populations of high school students. The system is the most prominent and prolific system in the Hispanic Association of Colleges and Universities (HACU), with 19 of our 23 campuses participating actively. Since the 1970's, the CSU has been one of the most Latino friendly university system in the nation. Today, 26.2% of our students are Latino.

• The CSU is committed to ensuring minority parent awareness and understanding of higher education. We have a three-year partnership with Parent Institute for Quality Education (PIQE) reaching 120 middle schools, 8,000 parents, and 25,000 school children every year. Its purpose is to increase the number of students eligible to enter the CSU from underserved communities. Through this partnership, parents are receiving training and resources that will prepare their children for a college education. The partnership helps parents to create a home learning environment, navigate the school system, and work collaboratively with teachers, counselors, and principals.

• The CSU has focused outreach activities aimed at creating a college-going culture among minority and low-income students throughout their elementary and secondary experience. In a partnership with the Boeing Corporation, the CSU publishes its now widely acclaimed "How to Get to College" poster. For California students who will be the first in their families to go to college, the information in this widely distributed poster about the steps to prepare for and apply for college and financial aid is extremely valuable. CSU has distributed the poster in English and Spanish to schools throughout California and now also distributes copies in Chinese, Korean, and Vietnamese.

• The CSU has a deep commitment to outreach programs equipping students from underrepresented groups for success in college. Our federal GEAR UP, TRIO, and Upward Bound programs are the largest in the country and represent major priorities across the entire CSU system. For example, eleven CSU campuses have been the fiscal agent for GEAR UP grants totaling over $112 million since the inception of the program in 1999, using these resources to encourage economically disadvantaged youth to aspire to college and preparing them for college and success.

• The CSU is dedicated to supporting talent development programs for students from underserved communities. For example, the CSU has nine MESA pre-college sites and eight MESA engineering program centers. CSU campuses with pre-college MESA programs work with over 180 schools and serve more than 9,000 students annually. Nearly 50% of the students in the MESA Community College Program in California transfer to CSU campuses and major in mathematics, engineering, science or technology.

• The CSU is engaged in partnerships having significant promise for preparing new groups of STEM professionals from diverse backgrounds who are first generation college goers. For example, we are working closely with the Hispanic Engineers National Achievement Awards Corporation (HENAAC) in planning a program that will provide early STEM career awareness and preparation for elementary, middle and high school students in inner city Los Angeles. HENAAC has developed plans for an outstanding project that will involve CSU Los Angeles as the primary higher education partner, include students, their families and teachers, and will be made possible through support of the Office of Naval Research.

While these targeted programs provide essential assistance to underrepresented students, programs that enhance the capacity of secondary schools to prepare all students for college success are also essential. The CSU Early Assessment Program is a nationally recognized collaboration involving the CSU, the California Department of Education, and the State Board of Education. It provides the opportunity for high school students to learn about their readiness for college-level English and mathematics in their junior year, and it makes available opportunities for them to improve these skills during their senior year so they can enter the CSU without requiring remedial coursework. By providing professional development for English and mathematics teachers across the state, the EAP is a major resource for increasing the readiness of students from high need communities to enter college ready for success.

*Concluding Comments*

The CSU has a significant commitment to advancing California's competitiveness, and is dedicated to building the foundations that are critical to preparing all students for STEM careers. This includes: (a) preparing the mathematics and science

teachers needed to equip California's students for success in STEM fields and (b) fostering access to STEM fields among students from the underrepresented groups that are an increasingly large portion of our workforce.

When students from diverse backgrounds begin their study on CSU campuses, there are dozens of outstanding programs that enable them to select and excel in STEM fields. Programs that provide special resources for these students include, for example, the excellent Louis Stokes Alliance for Minority Participation programs, the Minority Access to Research Careers (MARC) programs, and the Minority Biomedical Research Support (MBRS) programs found across CSU campuses. Also, many of our campuses foster undergraduate and master's level research in the STEM disciplines, leading to increased readiness among our students to become research and development STEM professionals. As evidence of our effectiveness, the National Science Foundation has consistently identified the CSU as a top baccalaureate institution of origin for STEM doctorate recipients. For example, a recent published study identified five CSU campuses among the top 50 undergraduate institutions of origin of Hispanic doctoral recipients.

There are, in addition, outstanding engineering programs that focus on increasing the numbers of underrepresented students excelling in engineering careers in the CSU. Programs such as the Minority Engineering Program (MEP) make available exceptional engineering opportunities and have significantly expanded participation of Latino and African-American students.

This past year, the CSU initiated a systemwide Professional Science Master's (PSM) program that offers innovative Master's degrees that prepare students for the state's highest growth sectors in industry and government. Eighteen PSM programs are in place or underway. Industry partners in PSM programs nationally include some of the nation's foremost science and technology firms. Enrollment of underrepresented minority students is substantial, and the 18 planned CSU programs will enable students from diverse backgrounds to develop the science, technology and management skills most needed in today's workforce.

The fundamental components of the CSU and the state's success reside in (a) developing the foundations for STEM careers through teacher preparation, (b) increasing access and participation of underrepresented groups, and (c) monitoring of the effectiveness of our efforts. These are approaches where the CSU has done more than almost any other institution in the nation and is committed to continuing its leadership.

Preparing an outstanding teaching force and making CSU a route of access for underrepresented students are guiding visions underlying our priorities as a system. We rigorously measure the outcomes of our efforts and make the adjustments to ensure our programs are effective. Through our hundreds of baccalaureate and master's degree programs, we will build on these critical underpinnings and continuously contribute to the future workforce needed to secure California's competitiveness in a global market.

I will be glad to respond to any questions you may have, and look forward to working with you in the future.

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Chairman HINOJOSA. Thank you.

Dr. Baker.

## STATEMENT OF DR. WARREN BAKER, PRESIDENT, CALIFORNIA POLYTECHNIC STATE UNIVERSITY

Dr. BAKER Thank you very much, Chairman Hinojosa. I appreciate the opportunity to comment on policy options for the renewal of California and the Nation's science and technology workforce, and our continued global technological and economic leadership.

We face considerable challenge sin renewing our college-educated science and technology workforce, and a few statistics help illustrate the magnitude of the challenge that we have here in California.

We know that in 2006, approximately 48 percent of our public school students were Hispanic, 20 percent were African, Asian and Native American. In addition, 25 percent of those students in the K-12 population were English learners.

The college participation rates of many of these students is way too low. A 2002 report estimated that less than 5 percent of California's Latino high school students graduate with college-ready skills.

We're not on track to meet California's need for college-educated workers, and by 2020, we will face a 20 percent shortfall in the number of workers that we will need requiring college education.

We've seen early warning signs of the consequences for science, technology, engineering and mathematics education. In the 1990's, the number of California bachelor's degrees in math and engineering declined by 13 percent.

California will see a significant decline in per capita income by 2020 unless rates of educational achievement improve, and this will occur across the Nation. To divert these dire trends, we must bring more students into higher education. To preserve the state's capacity for discovery and innovation, we must bring more students into STEM disciplines, and we must have a strong K-12 STEM education system aligned with the expectations of higher education and with industry.

And we must, most importantly, have qualified, effective and inspiring teachers in science and mathematics in the classroom for every student, teaching in a multilingual minority population as well.

Some steps that are being taken to address these were outlined by Chancellor Reed in his testimony, describing what the California State University is doing to provide access to California's population of young people, and as a university, one of the universities, we have formed P-12 councils and provided opportunities to work together with the constituents who have an interest in furthering the improvement of our K-12 system.

Earlier this summer, the Business Higher Education Forum, and other members of the initiative, Tapping America's Potential, wrote to Representatives Miller and Hinojosa, and other Congressional leaders, in support of reauthorization of the Higher Education Act, and, in particular, the policies that would improve U.S. STEM education at all levels.

I am supportive of these recommendations and I would also invite the subcommittee to review the findings and recommendations of two recent business higher education reports that Raytheon CEO Bill Swanson and I co-chaired. the first, in 2005, a commitment to America's future, responding to the crisis in mathematics and science education, and the most recent, 2007 report, An American Imperative, Transforming the Recruitment, Retention and Renewal of our Nation's Mathematics and Science Teaching Workforce.

In keeping with the spirit of the recommendations of TAC and the Business Higher Education Forum STEM initiative, I would like to encourage the committee to give special consideration to several potential initiatives which are in my written testimony.

I would like to point out three of these. First, I would encourage consideration of federal policies that support the establishing of P-16 councils in each of the 50 states, charged with developing statewide plans to promote and strengthen student access and success in science and mathematics, from pre-school to university, with particular emphasis on leadership from business.

Second, federal policies that support and encourage the work of established and effective STEM outreach recruitment and retention programs, like these that I have shown on this slide.

And finally, federal policies that support the extension of what we call a teacher as scientist programs, which meets the requirements that we hear from young people considering teaching programs, about being involved in science. And the national labs programs have been particularly effective, here, in the State of California, where we have had experienced teachers having opportunities to work in the summer and to provide hybrid opportunities and careers for these students in the national labs while they are teaching, primarily in the summer.

We also know that these programs have doubled the rate of retention compared to the average science and math teacher, when they participate in these programs with the national labs, and, by the way, corporate and private laboratories as well.

We also believe that this will be an effective recruitment tool, and we have launched a program this summer, with Lawrence Livermore, to bring prospective teachers of science and mathematics into these laboratories.

I interviewed all of these students this summer and asked them if they were going to continue to pursue careers in teaching. They were even more excited about the opportunities that they could bring in hands-on learning, and in critical thinking, to the classroom as a result of their experiences with the national labs. Thank you very much.

[The statement of Dr. Baker follows:]

**Prepared Statement of Warren J. Baker, President, California Polytechnic State University**

To Chairman Hinojosa and members of the Sub-Committee, I would like to express my appreciation for the opportunity to comment on the growing need for graduates in science, technology, engineering and mathematics (STEM) disciplines, some of the steps we are taking at California Polytechnic State University (Cal Poly) to address this need, and additional policy measures that might be implemented at the federal level to help us address this issue at the state and local level.

*Background*

The United States and particularly California have enjoyed significant economic gains over the past half century. Much of this growth has come from investments in science, engineering and technology education and research and from creation of the world's pre-eminent universities. Thanks to investments since WWII, we have become the world leader in scientific and technological discovery and innovation, to the great benefit of our standard of living and quality of life. Our leadership position is now being challenged by rapid progress in science and technology in other industrialized nations, fueled by strong rates of public investment in education and research, including establishment of first-class universities.

According to the National Science Foundation's biennial report on science and engineering, natural science and engineering doctoral degree production is either not increasing or declining in Western nations like the U.S., United Kingdom and Germany, while it is increasing in China, South Korea and Japan (NSB 2006:2-6). The proportion of U.S. bachelor's degrees conferred in science and engineering disciplines remained relatively constant over the past two decades (about one-third of the total), but the proportion of degrees granted in engineering declined from seven percent to five percent during that period (NSB 2006:2-4). The report documents continued low rates of baccalaureate degree completion among underrepresented minorities in the U.S. For example, only 10 percent of Hispanics aged 25-29 had completed a baccalaureate degree in 2003, compared to 34 percent of whites (NSB 2006:2-5). This is a particularly worrisome statistic for California, with its large Hispanic population. A 2002 report estimated that "less than five percent of [California] Latino high school students graduate with college-ready skills" (CCST 2002:45). We have

seen early warning signs of the potential consequences of the state's changing demographics for STEM education. In the 1990s, the number of California baccalaureate degrees in mathematics and engineering experienced a 13 percent decline (CCST 2002:67).

Recently, a number of celebrated reports have called for renewed investment in STEM education to reverse decline in the nation's relative strength in science and technology and regain our technological leadership. To cite just a few examples:

• In 2005 a blue ribbon committee of the National Academies, responding to a congressional charge, issued the report, "Rising Above the Gathering Storm." It recommended key steps the nation must take to preserve its capacity to compete technologically and economically in an increasingly competitive global environment. Two of the four main recommendations in this report called upon the nation to expand its investment in STEM education—from kindergarten through graduate school.

• In two other recent national reports, the Business-Higher Education Forum highlighted the critical role that K-12 science and mathematics education play in preparing students to pursue STEM careers:

• the 2005 report, "A Commitment to America's Future: Responding to the Crisis in Mathematics and Science Education," and

• the 2007 report, "An American Imperative: Transforming the Recruitment, Retention, and Renewal Of Our Nation's Mathematics and Science Teaching Workforce."

These reports call upon the nation to make it an urgent national priority to strengthen K-12 science and mathematics education and in particular to invest in renewal of the science and mathematics teacher workforce.

• The California Council on Science and Technology raised similar concerns in several reports over the past decade:

• the 1999 "California Report on the Environment for Science and Technology,"

• the 2002 "Critical Path Analysis of California's S&T Education System," and

• the 2007 "Critical Path Analysis of California's Science and Mathematics Teacher Preparation System."

These reports documented strong continuing demand for science and technology workers in the California economy, an educational system that is failing to keep pace with this demand, and a K-12 science and mathematics teacher workforce that is being eroded by retirements and attrition without sufficient numbers of qualified replacement teachers.

Against the background of these reports, and with the assistance of other recent policy analyses, I would like to share several observations on the nature of the challenges we face and steps we can take to sustain and renew the California STEM workforce and ensure continued vitality of the State's economy.

• California will need a growing number of college-educated workers in coming decades, but we are falling short in meeting this demand. According to the Public Policy Institute of California, in 2020 75 percent of jobs will require at least some college but only 61 percent of the workforce will have achieved this level of education; 39 percent of jobs will require a college degree but only 33 percent of workers will have attained one (Public Policy Institute of California 2005:1).

• Given projected rates of educational participation and achievement, the state will experience significant decline in per capita income. This is something that should concern all Californians. The National Center for Higher Education Management Systems has projected the future economic consequences of educational trends in the fifty states. California is projected to experience a $2,475 decline in per capita income by 2020 if we are not successful in increasing rates of educational participation and completion (Kelly 2005:25).

• Our ability to remain globally competitive as a state depends especially on our capacity for scientific and technical innovation. This in turn depends on our ability to engage students at a young age in the study of science and mathematics and to encourage them to embark upon college and university programs in STEM disciplines.

• We know that a strong K-12 educational system, with a curriculum and pedagogy responsive to the expectations of higher education and the workforce, is of critical importance in meeting our future STEM workforce needs.

• We also know from educational research that perhaps the single most important thing we can do to promote student involvement and success in STEM disciplines is to be sure that every K-12 student is taught science and math by competent, effective and inspiring science and math teachers while we continue to make needed investments in college programs, laboratories and faculty.

• But we face significant challenges:

While progress has been made through the implementation of new educational standards in California and the other states, additional work is needed to ensure

that K-12 educational systems are responsive to the expectations and requirements of colleges, universities and workplaces.

The U.S. will need more than 280,000 new mathematics and science teachers by 2015 (BHEF 2007:4). We face a similar challenge in California. Over the next decade the state will need over 33,000 new mathematics and science teachers (CCST 2007:3). Even though the CSU and UC systems have ambitious plans to increase the number of science and math teachers they prepare, we have not yet caught up with demand. In 2005-06, 35 percent of new California science teachers and 40 percent of new math teachers were under-prepared (lacking even a preliminary teaching credential) (CCST 2007:22). Shortages of qualified science and math teachers are particularly acute at schools that have large percentages of students from minority and low-income backgrounds.

To ensure a continued adequate supply of science and technology innovators in California, we must continue to work to strengthen K-12 science and math programs and make it a special priority to prepare a new generation of science and mathematics teachers.

We must also invest in our universities and community colleges to increase access to STEM programs and to ensure that those programs are innovative, of high quality and responsive to rapid changes in science, technology and society. Weak STEM programs in K-16 education are now resulting in a shortage of advanced degrees in STEM fields. We will soon feel these effects in our universities and national laboratories.

*Some Steps Being Taken at Cal Poly to Address the Crisis in STEM Education*

Chancellor Reed's testimony to the committee describes in some detail steps being taken by the California State University to address the State's need for STEM graduates and in particular the need for qualified and inspiring science and mathematics teachers. I would like to share with the committee some steps that are being taken at one campus, in collaboration with partners in government and industry, to strengthen collaboration with the K-12 system and community colleges and to prepare additional science and mathematics teachers.

*K-12/Higher Education/Industry Collaboration*

In April of 2005, a P-16 Council was established in San Luis Obispo County. It has brought together leaders in K-16 education, business, and the community to address "critical gaps in educational achievement."

An early focus of the Council's work is an initiative on Mathematics and Science Education. It has identified the following goals:

1. Recruit and prepare well qualified P-16 teachers in science and mathematics.
2. Provide professional development for P-16 science and mathematics teachers.
3. Engage P-16 students in science and math and promote careers in science, technology, engineering and mathematics (STEM).
4. Serve as a repository/disseminator of best practices in P-16 science and mathematics Education.[1]

While this local effort is still in its early stages, we concur with the Business-Higher Education Forum and others that P-16 Councils can play critical roles in bringing together education, business and community stakeholders to achieve greater alignment of the educational segments and stronger preparation of graduates to meet the expectations of workplaces and higher education programs.

*Teacher Recruitment and Preparation*

Cal Poly has taken several important steps to address the state's need for science and mathematics teachers, including:

1. Development of a new undergraduate program that prepares chemistry majors for teaching careers in four years and a term.
2. Collaboration between the College of Education, College of Science and Mathematics and College of Engineering in teacher recruitment and preparation.
3. Creation of a University Center for Excellence in Science and Mathematics Education (CESaME) with the following goals:[2]

- To help recruit and prepare K-12 teachers who are confident of their skills in mathematics and their understanding of the natural world, and who are dedicated to helping all children to become scientific literate citizens of the 21st Century.

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[1] Cal Poly Center for Excellence in Science and Mathematics Education (*http://cesame.calpoly.edu/P-16.htm)*

[2] Cal Poly Center for Excellence in Science and Mathematics Education (*http://cesame.calpoly.edu/Vision.htm)*

• To offer practicing K-12 teachers opportunities to enhance their knowledge of science and mathematics and to guide them to the "best pedagogical practices" of presenting that knowledge to children and young people.

• To explore and develop new ways of enhancing the science and mathematics learning of all students K-16, particularly less advantaged students.

• To promote careers in Science, Mathematics, Engineering and Technology(STEM) among K-12 students.

4. Recruitment of prospective science teachers through a Teacher-Scientist model that introduces science majors to a dual career as teacher during the academic year and paid science researcher in the summer.

Across the country, through partnerships with Federal laboratories and with major science and technology firms, science and mathematics teachers have opportunities to participate in summer laboratory research programs and enjoy an innovative career pathway in which they are both teachers and researchers.

Sometimes called "teacher as scientist" programs, these opportunities:

• Allow teachers to gain first hand experience in the applications of science and mathematics within applied research settings.

• Foster inquiry-based teaching and learning strategies.

• Foster development of learning communities in the schools and a sense of participation by science and math teachers in an extended community of scientific colleagues.

• Include the added prestige of teachers having a joint assignment in an industry setting.

• Provide opportunities for teachers to supplement their salaries.

• Open the door to assistance from industry and national labs with school laboratories, including support for experiments, field trips, and guest scientists.

There is evidence that these programs promote science and math teacher retention. For example, impressive results have been reported by Industry Initiatives for Science and Math Education (IISME), "founded in 1985 by a consortium of San Francisco Bay Area companies in partnership with the Lawrence Hall of Science at the University of California at Berkeley" to allow teachers to carry out summer projects in industry settings (See: *http://iisme.org/). A 2001 evaluation of the IISME program found that IISME teacher participants ("Fellows ") were only half as likely to leave classroom teaching as other California teachers (Weisbaum and Huang 2001:3).*

We believe that teacher scientist programs may also have a positive impact on the recruitment of science and mathematics teachers. Therefore, in collaboration with the CSU Chancellor's Office, CSU-East Bay, a number of sister CSU campuses and Lawrence Livermore National Laboratory, Cal Poly is exploring an expanded vision of the teacher scientist program concept, extending this opportunity to science majors who are prospective teachers.. We believe this pilot program's emphasis on pre-service candidates and early development of a dual career identity is perhaps unique.

A pilot Teacher Scientist project was undertaken this summer at Lawrence Livermore National Laboratory. It placed 16 outstanding science majors from four CSU campuses in research labs for paid summer research internships. Half were majors in the three areas in which the state faces the severest shortages of science teachers: physics, chemistry, and geosciences. The purpose was to enable these science majors, all of whom had a serious interest in high school teaching, to begin an innovative science career that combines teaching at the secondary grade level with paid summer research on a sustained basis.

Initial evaluation results have been highly positive. The 16 CSU students were judged as being well-prepared research team members by the mentor scientists with whom they worked. Each prepared a high quality presentation for the Lab's annual student Poster Session. The students identified a broad range of areas in which they gained significant knowledge, ranging from a conceptual understanding of the research issues explored, to a deep appreciation of the nature of scientific inquiry and an understanding of the most sophisticated equipment used in scientific research. Participants have the opportunity to participate in paid summer experience during future years. Long-term evaluation of this pilot is planned, with a design that focuses on the impacts of the laboratory research experience and the hybrid science teacher identity on the professional paths of these science majors.

*STEM Outreach and Recruitment*

Universities like Cal Poly have important responsibilities for outreach to parents and prospective students to encourage preparation for collegiate study. In Cal Poly's case we have particular responsibility in the State of California for fostering awareness of STEM academic and career opportunities and we have a number of pro-

grams and initiatives that work to promote wider participation by California students in these fields and disciplines. I will mention a few examples of efforts that we believe to be effective:

• Cal Poly's Admissions Office uses sophisticated targeted marketing approaches to reach out to 10th and 11th grade prospective students all across the State of California, including students from populations traditionally underrepresented in STEM academic programs. As described by James Maraviglia, Assistant Vice President for Admissions, Recruitment and Financial Aid, methods used to communicate with these prospective applicants include "flash/video e-messages, broadcast phone messages, text messages, parent and student blogs, our new student portal, direct mail, virtual view books and telemarketing." For fall 2007 Cal Poly received a record number of undergraduate applicants for the 13th year in a row (34,173). The campus received applications from over five thousand Hispanic/Latino students, double the number received in 2000.

• During the past few years, Cal Poly has developed a special relationship with 191 "Partner" high schools, all of which have a large percentage of first generation students as well as historically low college-going rates. We help students at these schools to learn about Cal Poly and encourage them to complete the rigorous course of study necessary to be competitive in Cal Poly's admissions selection process.

• In collaboration with the California-based "Parent Institute for Quality Education" Cal Poly is bringing information about college readiness to parents of elementary and middle school students in communities traditionally underrepresented in higher education. Recently a first cohort of 160 parents of students in Guadalupe, a predominantly Hispanic central coast agricultural community, completed a nine week program that gives them skills to aid their children in preparing for college.

• With support from the University of California, Cal Poly conducts a MESA Schools Program (Mathematics, Engineering, Science, Achievement) to promote science and math success among pre-college students and awareness and participation in STEM higher education programs.

• Cal Poly student engineering association chapters participate in invaluable STEM-related outreach to diverse K-12 student populations. Examples of these student organizations include Cal Poly chapters of AISES (the American Indian Science and Engineering Society), SHPE (the Society of Hispanic Professional Engineers), NSBE (the National Society of Black Engineers), and SWE (the Society of Women Engineers).

These are just a few examples of an array of outreach efforts at Cal Poly—formal and informal—that engage students, faculty and staff in promoting awareness of STEM academic and career opportunities and encourage students to prepare for post-secondary study in these disciplines.

*Potential Federal Policy Initiatives*

Earlier this summer, the Business-Higher Education Forum and other members of the initiative, "Tapping America's Potential," wrote to Senators Kennedy and Enzi and Representatives Miller, McKeon, Hinojosa and Keller in support of reauthorization of the Higher Education Act (HEA), and in particular "policies that would improve U.S. science, technology, engineering and mathematics (STEM) education at all levels" (TAP 2007).

The letter urges federal policy support for efforts to:

1. Align K-12 Education with College and Workplace Expectations: The TAP letter advocates grants in support of state P-16 councils, as a key to strengthening the ability of schools and teachers to prepare graduates, whether they are moving into the workforce or pursuing further study. At Cal Poly we believe P-16 councils at all levels can play an extremely valuable role in ensuring that students receive early and ongoing preparation in science and mathematics so that they may go on to pursue careers and/or advanced study in STEM fields. These councils also provide an important opportunity for business to assume a position of expanded policy leadership in support of efforts to reform and strengthen P-16 education.

2. Recruit and Retain High Quality and Effective Math and Science Teachers: The TAP letter echoes the recent Business-Higher Education report and other recent reports in calling for policy initiatives to "attract and retain math and science teachers and strengthen teacher preparation programs." Financial assistance for aspiring teachers, better alignment of teacher preparation with state content standards, incentives for math and science teachers to serve at "high-need schools" are among the promising measures recommended. In addition to these recommendations, I might also suggest consideration of support and incentives for expansion of Teacher Scientist programs in industry and national labs, providing laboratory research experiences starting in the pre-service phase of student preparation and extending into at least the early years of their teaching careers.

3. Motivate Students to Study and Enter STEM Careers: The TAP letter advocates "incentives for colleges and universities to produce more STEM graduates," including expanded support for undergraduate and graduate scholarships for STEM students and support for development of professional science master's degree programs. Along with these promising recommendations I would suggest considering additional steps to support and encourage the work of established and effective STEM outreach, recruitment and retention programs, including but not limited to programs like MESA (Mathematics, Engineering, Science, Achievement) and organizations like the National Action Council for Minorities in Engineering (NACME), AISES (the American Indian Science and Engineering Society), SHPE (the Society of Hispanic Professional Engineers), NSBE (the National Society of Black Engineers), and SWE (the Society of Women Engineers). Among the outreach initiatives that have shown particular merit and promise over the years, one might include summer campus for elementary and middle school girls, engineering summer camps and robotics competitions.

*References Cited:*

*Business-Higher Education Forum (BHEF)*

2005 "A Commitment to America's Future: Responding to the Crisis in Mathematics and Science Education."

2007 "An American Imperative: Transforming the Recruitment, Retention, and Renewal Of Our Nation's Mathematics and Science Teaching Workforce."

*California Council on Science and Technology (CCST)*

1999 "California Report on the Environment for Science and Technology."

2002 "Critical Path Analysis of California's S&T Education System."

2007 "Critical Path Analysis of California's Science and Mathematics Teacher Preparation System."

*Cal Poly Center for Excellence in Science and Mathematics Education (http://cesame.calpoly.edu)* Kelly, Patrick J.

2005 "As America Becomes More Diverse: The Impact of State Higher Education Inequality." National Center for Higher Education Management Systems (NCHEMS).

*National Academy of Sciences, National Academy of Engineering, Institute of Medicine*

2007. "Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future. Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology."

*National Science Board (NSB)*

2006. Science and Engineering Indicators 2006. Washington, DC.

*Public Policy Institute of California*

2005 "Getting to 2025: Can California Meet the Challenge." Research Brief, Issue #100, June 2005.

*Tapping America's Potential (TAP)*

June 8, 2007 letter to Senators Kennedy and Enzi and Representatives Miller, McKeon, Hinojosa and Keller regarding reauthorization of the Higher Education Act (HEA) (*http://www.tap2015.org/news/HEA—letter.pdf*). Weisbaum, Kathryn Sloane and Danny Huang

2000 "IISME Teacher Retention and Program Impact 1985-2000." Industry Initiatives for Science and Mathematics Education (IISME).

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Chairman HINOJOSA. Thank you very much.

Dr. Tarantino.

## STATEMENT OF DR. FRED TARANTINO, PRESIDENT, UNIVERSITIES SPACE RESEARCH ASSOCIATION

Dr. TARANTINO. Chairman Hinojosa, thank you for this opportunity to appear before this committee today.

It is my pleasure to testify on a topic that is important to all of us, American competitiveness in science, technology, engineering and mathematics disciplines.

My remarks draw from my experience as the president and CEO of the University Space Research Association, USRA, a nonprofit association of 101 major space science and technology research universities.

As a long-term federal partner, USRA provides a mechanism through which universities can cooperate effectively with one another, with the Government and with other organizations, to further knowledge in space science and technology and to promote education in these areas.

As you know, American competitiveness in math and science is declining. This decline is occurring just as space is generating new opportunities. Space isn't just creating jobs. It's creating entirely new markets and prospects for economic growth that have not previously existed.

It is affecting every aspect of how we live, enabling communications, telemedicine, point to point GPS navigation, weather and climate modeling, and is even starting to form an embryonic tourism business in Earth orbit.

Another very important benefit of space research is the skills it develops in people. Succeeding in the ever-heightening global competitive environment requires technological innovation to drive competitiveness and growth.

Many things can cause innovation to occur. However, in space, scientists and engineers are compelled to innovate daily. Space research, including human and robotic exploration of space, cannot be accomplished without know-how beyond what we have today. It is bold, exciting science and engineering. It inspires people to do their best, to innovate and discover on a scale that is unmatched anywhere else.

That innovation translates into improved competitiveness, broadly, across all economic sectors, not only in space, but in areas as diverse as commercial electronics, medical treatment and disaster preparedness.

USRA's member institutions have spent considerable time studying this, and, in turn, USRA strongly supports funding for the Congressional innovation agenda in the president's American competitiveness Initiative.

These should help address key needs to replace an aging space workforce. Today, our institutions of higher education are producing insufficient numbers of graduates to meet the space workforce needs.

A key reason for this is that within universities, there are fewer opportunities for students to gain experience they need. For example, a review of the annual number of flight opportunities where graduate students can be involved in designing and experiment, building hardware, and analyze net data that returns after it is launched into space, shows a steady decline, over time.

In fact, over the last 40 years, U.S. suborbital launches have decreased 80 percent, from 270 per year to just 50 planned launches this year, in 2007. This has resulted in a severe drop in the training opportunities our universities provide students, in turn, limit the ability to recruit students into space studies.

Without such research, it is not possible to train the highly-specialized workforce that would keep America competitive in space and receive the associated benefits that provides.

This issue is very important to USRA's members. Last year, we canvassed our universities on their most pressing concerns. The response was surprising for its uniformity and unanimity. Across the country, faculty representatives cited the shortfall in student space-flight opportunities as the single most important need.

At our annual meeting this year, members voted unanimously on a resolution urging action, and for this reason USRA is asking Congress to double spending on research and training opportunities for students in these areas.

We also have considerable success in motivating students by introducing them to the space research environment.

For example, USRA is the NASA contractor for the Stratospheric Observatory for Infrared Astronomy, SOFIA.

Managed here, in California, at the Dryden and Ames Research Centers, SOFIA is a world-class astronomical observation in a Boeing 747 aircraft. It is designed to make observations while flying at 40- to 45,000 feet, and will begin collecting scientific data in 2009.

SOFIA also provides a unique educational resource that will unite teachers and practicing scientists in meaningful long-term relationships. The aircraft has a special educator seating section, that will enable thousands of teachers to fly aboard the observatory during its lifetime and directly contribute the recommendations of the Rising Above The Gathering Storm report to train 10,000 teachers, 10 million minds.

It is the only major astronomical observatory designed from the start to foster partnerships between educators and scientists in the operating research environment.

In closing, I would like to commend the subcommittee for its commitment to our universities and for support of higher education funding.

Thank you for this opportunity to appear before you today. I look forward to working with you and I am happy to answer any questions.

[The statement of Dr. Tarantino follows:]

**Prepared Statement of Dr. Frederick A. Tarantino, President and CEO, Universities Space Research Association**

Chairman Hinojosa, Ranking Member Keller and Members of the Subcommittee, thank you for this opportunity to appear before the Subcommittee on Higher Education, Lifelong Learning and Competitiveness of the House Education and Labor Committee. It is my pleasure to testify today on a topic that is so important to all of us—American competitiveness in the science, technology, engineering and mathematics disciplines.

My remarks draw from my experience as the President and CEO of the Universities Space Research Association (USRA), a non-profit association of 101 major space science and technology research universities.[1] As a long-term partner with the federal government on a variety of initiatives that extend the boundaries of our scientific expertise, USRA provides a mechanism through which universities can cooperate effectively with one another, with the government, and with other organizations to further space science and technology, and to promote education in these areas.

To give you a context for my passion for this subject, I would like to share with you a bit about my background. While with the U.S. Army, I served in a variety of space power research and program management assignments. I later served as

Defense Liaison in the White House Office of Science and Technology Policy, and as Executive Assistant to the National Security Council Senior Director for Science and Technology. In the private sector, I was the President and General Manager of Bechtel Nevada Corporation, responsible for management and operations of the Nevada Test Site, and as the Principal Associate Director at Los Alamos National Laboratory with responsibility for managing the laboratory's science-based weapons stewardship program.

Through my experiences in the government, private sector and a non-profit university research association, I have gained an appreciation for the importance of education and research in the science and technology fields.

Today, I would like to discuss three topics that are essential to our national education and workforce development initiatives. First, the critical workforce need of the 21st century in space sciences and technology. Second, the importance of strengthening our nation's education and public outreach programs, and finally, the need for federal reinvestments in university research programs.

As is well known, the status of American competitiveness in the important areas of math and science is declining. In 2005, the National Academies of Sciences report titled "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future" recommended: (1) improving K-12 math and science education, (2) sustaining and strengthening basic research, (3) enhancing higher education in science and engineering, and (4) creating economic incentives for innovation.[2]

USRA's member institutions have spent considerable time reviewing these findings and, in turn, USRA has developed four recommendations for improving American competitiveness in the science and engineering fields. First, we must increase funding for Education and Public Outreach programs at the university level. Second, Congress must appropriate sufficient funding for the various elements of the Congressional Innovation Agenda and the President's American Competitive Initiative. Third, Congress must include adequate funding for NASA in its Innovation Agenda and American Competitiveness Initiative plans. Finally, Congress must double in five years federal spending on research and training opportunities for undergraduate and graduate students in the mathematics, the physical sciences and engineering disciplines.

*Workforce Needs of the 21st Century*

Today, the technical workforce in the aerospace and space science industry is facing two key issues: (1) the need to replace an aging workforce, and (2) the need to provide highly technical training at the university level to develop the future leaders of U.S. space research. Statistics highlighting the aging American aerospace workforce are well documented:[3]

- The U.S. aerospace industry employed an average of about 630,000 workers in 2006, and 75,000 of these workers are in space-related jobs (31,400 military and 43,600 civilian).
- 27% of the aerospace engineering workforce will be eligible for retirement by 2008.

Similarly, institutions of higher education are not producing a sufficient number of students to fill the workforce needs of the aerospace industry.

- Of the 70,000 engineers graduating annually, only about 40,000 are qualified to work for the U.S. aerospace industry.

These problems are occurring for two key reasons: (1) competition for America's best minds has shifted much of the resources and talent towards scientific pursuits in other areas such as computer programming and related next-generation high-tech specialties, and (2) there are fewer opportunities than ever for the next generation of students to gain the training and experience they need to succeed in tomorrow's aerospace specialties. A review of the annual number of flight opportunities where graduate students can be involved in building hardware and analyzing the space data returned from it shows a steady decline over the last two decades. In fact, over the last 40 years, U.S. suborbital experimental launches have decreased 80%—from 270 per year to just 50 planned launches in 2007. Decreases in suborbital launches have resulted in a corresponding drop in the hands-on training opportunities our universities provide to undergraduate, masters and doctoral students in hard sciences, and have limited our universities' ability to recruit high quality students into space studies. Without these hands-on research opportunities at the university level, it is not possible to train a highly specialized technical workforce that will keep America competitive in the future global economy.

This issue is of critical important to USRA's member universities. Last year, we canvassed our members on their most pressing interests and concerns that needed to be addressed at the national level. The response was surprising for its uniformity

and unanimity. Across the country, faculty representatives from our member universities cited the shortfall of student space-flight opportunities providing graduate student involvement as the single most important need.

In response, USRA began working to address this issue. At USRA's annual meeting in March of 2007, our 101 member university body unanimously passed a resolution (attached to this report) urging federal support for increased student opportunities to get hands-on experience in space tests. Given the graduate program structure, these opportunities are most often found on sounding rocket, balloon, and small spacecraft flights.

To help maintain American competitiveness in critical areas to national economics and security, USRA is asking Congress to double in five years federal spending on research and training opportunities for graduate students in mathematics, sciences and engineering disciplines.

*Strengthening Education and Public Outreach Programs*

Ever since the 1983 Department of Education (DOEd) report, A Nation at Risk, pointed out significant shortcomings within the American public school systems, the national education reform effort has been building. As part of its mission, the National Science Foundation (NSF) has compiled reports on the health of the nation's educational system. Two interrelated reports, supplying data on U.S. mathematics and science education, indicate results of national and local level reform efforts are generally positive, but mixed.[4] The average amount of classroom time devoted to science and math for grades one through six rose substantially since the late 1970s. Schools are imposing stricter science and mathematics high school graduation requirements, and are increasing availability of advanced science and mathematics courses nationwide.[5] On the other hand, the report documents great disparities in proficiency gains from state to state scores for white students remain significantly higher than for black and Hispanic students; and the U.S. still fares poorly in comparison to other developed countries. The NSF, as well as the Department of Education, has been working toward the "systemic" reform of grades K-12. This refers to the need for fundamental changes in science, mathematics, and technological literacy by stimulating reforms in school policy, financing and management, as well as reforms in course conduct and content.

USRA strives to complement the systemic reforms being undertaken in the U.S. by enabling students and teachers to share in our nation's space research experiences. We have considerable success in bringing students into the NASA research environment, and in bringing NASA research into the classroom, either in the form of properly configured teaching materials or by coordinating the in-person/hands-on presence of NASA engineers and researchers.

As an example of our efforts to connect students and teachers with leading space research initiatives, let me briefly describe one of our major activities and how USRA relies on its institutes and programs to take the lead on educational initiatives related to space science disciplines. USRA is the prime contractor to NASA for the development and operation of the Stratospheric Observatory for Infrared Astronomy (SOFIA). Managed out of California at NASA's Dryden and Ames Research Centers, SOFIA is a well-known world-class astronomical observatory, with a 2.5-meter telescope designed to provide infrared and sub-millimeter scientific observations into the next century.

SOFIA provides a unique educational resource that will unite teachers and practicing scientists in meaningful, long-term relationships. As a modified Boeing 747, SOFIA is designed with a special educator seating section that will enable thousands of teachers to fly aboard the observatory during its lifetime, and directly contribute to the recommendation of the Rising Above the Gathering Storm report to "train ten thousand teachers, ten million minds." SOFIA is the only major ground- or space-based observatory designed from the start, both physically and administratively, to foster partnerships between educators and scientists in a research environment. Over 600 teachers and other education professionals, such as museum and planetarium workers involved in science education, have already indicated their interest in the SOFIA educational program.

*The Need for Reinvestments in University Research Programs*

America's leadership in science and technology markets has helped secure the standards of living we have enjoyed for decades. Currently, the U.S. employs close to one-third of the world's researchers in science and engineering, and accounts for 40% of all R&D spending, though it possesses only 5% of the world population. Yet at the dawn of the 21st century, our nation faces an unprecedented level of global competition in emerging science and technology markets. These technical and scientific achievements are directly linked to the unparalleled quality of American uni-

versities since World War II. There is competition from universities in China, India and other countries in both research and investments in infrastructure. We cannot afford to lose this edge, and investments in research are an important component of this race. We commend your support of the Congressional Innovation Agenda and the President's American Competitiveness Initiative which increase federal investments in research and development (R&D) at our universities and serve as the key platforms for maintaining our nation's leadership in the technology and science areas.

While our universities still lead the rest of the world in both undergraduate and graduate research and education, they face serious challenges. One of these challenges is the need to strengthen the research funding that has been essential in attracting the best and brightest students to the engineering and scientific fields. Since the early 1990s, federal and state funding has been flat or declining in real terms.[6] This has challenged the universities in continuing to develop a workforce that will ensure our nation's ability to compete effectively in an increasingly global and technologically-oriented economy.

One key recommendation from the 2007 National Research Council report entitled "Building a Better NASA Workforce: Meeting the Workforce Needs for the National Vision for Space Exploration" is that NASA should make workforce-related programs, such as the Graduate Student Researchers Program and co-op programs, a high priority within its education budget. NASA should also invest in the future aerospace workforce by partnering with universities to provide hands-on experiences for students and opportunities for fundamental scientific and engineering research specific to NASA's needs. These experiences should include significant numbers of opportunities to participate in all aspects of suborbital and Explorer-class flight programs and in research fellowships and co-op student assignments. USRA urges Congress to provide increased federal funding for critical hands-on training opportunities at the university level.

In closing, I would like to commend the Subcommittee for its commitment to our universities and for support of funding higher education programs. In addition to other government agencies, NASA continues to play an important role in educating our nation's technical workforce. Much of the exciting space research conducted at our member universities is funded by Research and Education programs from NASA, and we appreciate your continued support of these programs.

We at USRA believe that strengthening our higher education institutions is essential to our national security and to maintaining our competitive edge in the global marketplace.

Thank you for this opportunity to appear before you today. I look forward to working with you and I would be happy to answer any questions.

ATTACHMENTS

**USRA White Paper on Educating the Next Generation of Space Scientists and Engineers**

"Our policymakers need to acknowledge that the nation's apathy toward developing a scientifically and technologically trained workforce is the equivalent of intellectual and industrial disarmament and is a direct threat to our nation's capability to continue as a world leader." (The Report of the Commission on the Future of the U.S. Aerospace Industry, November 2002)

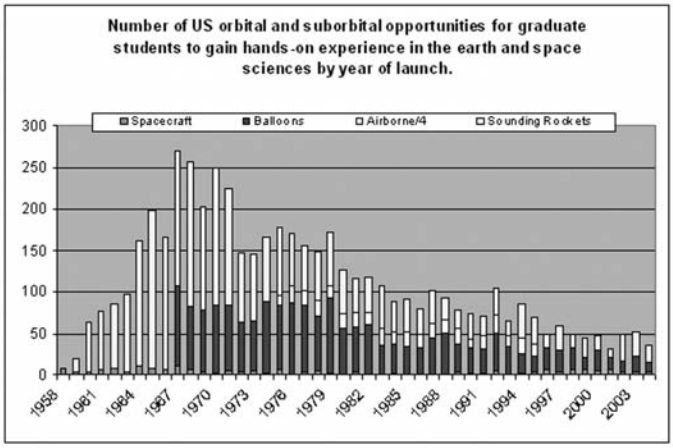
"At present, there are insufficient methods for students to acquire hands-on experience in the scientific and technical disciplines necessary for space commerce and exploration." (Commission on Implementation of United States Space Exploration Policy (the Aldridge Report), June 2004)

There is a significant deficit of scientists and engineers in the United States with meaningful hands-on experience with space instrumentation and space systems, which is jeopardizing the ability of the nation to maintain a vigorous presence in space into the future, regardless of whether we are in space for reasons of commerce, exploration, national defense, or scientific research. This deficit leads not only to a loss of capability, but also to escalating costs of many of the space systems vital to the nation's security and industrial competitiveness.

Space scientists and engineers are trained at universities, particularly in the science and engineering graduate programs of those research universities active in space research. To attract good students into these fields requires sufficient funding for graduate stipends from either research projects or graduate fellowships, and projects or research opportunities that excite students so that they choose space research over other possible areas. These projects or research opportunities must also provide the students with the range of experiences they need to become fully trained scientists and engineers.

The scientists and engineers who learned their trades during the first decades of the space age have reached or are nearing retirement. These were exciting years

for a young person to enter space research, and space attracted many of the best young scientists and engineers. These years were marked by frequent launches of smaller missions many of which were led by university-based teams that included graduate students. These students got plenty of hands-on experience, and learned first hand the difficulties of designing and constructing an experiment or engineering system that would operate reliably in space. Many students also learned from designing and building experiments for smaller, suborbital flights on rockets or balloons, or by observing with an airborne telescope.




The chart shows that the number of these opportunities peaked in 1968, at the height of the Apollo program. Since then the number of student opportunities provided by spacecraft missions, rocket and balloon fights and airborne observatory sorties has diminished from over 250 per year to consistently less than 50 per year. Most graduate students now never have an opportunity to do hands-on science. Instead the vast majority of science PhD students analyze data obtained from instruments they have never seen and thus have only a vague idea of how they work or how they might malfunction. They certainly don't learn the important skills needed to conceive of, and to help design and construct a space experiment.

The chart hides another phenomenon. As space missions have, necessarily, become more complex, they also take longer to design and construct. The increasing complexity means that fewer universities have the resources and capabilities of managing the complexity, so increasingly missions are being run by non-academic laboratories and research centers. The mission time scale is now significantly longer than a typical graduate student remains in school. Both of these effects significantly decrease the likelihood of graduate student involvement, exacerbating the problem.

This is a national problem. It affects not only space science, but also human space exploration, global climate prediction, commercial ventures in space, and national security uses of space. All these enterprises require space engineers able to design and construct reliable space hardware, and space scientists who understand the space environment and the rigors of conducting any activity, robotic or human, in space.

*What needs to be done?*

These critical needs are addressed by a proposed hands-on, rapid cycle flight program of moderate risk that focuses on inexpensive system development for suborbital and orbital applications. This program should provide multiple flight opportunities involving graduate and undergraduate students from science and engineering disciplines, and should provide the excitement of discovery to attract those who will become leaders of the future U.S. space enterprise. The program should permit a four-fold increase of hands-on experiences over present levels to return to the peak levels of the 60's and 70's. The proposed level of activity should allow an average of two launches per month or more.

RESOLUTION OF THE
COUNCIL OF INSTITUTIONS OF THE
UNIVERSITIES SPACE RESEARCH ASSOCIATION

We being the members of the Council of Institutions ("Council") of the Universities Space Research Association ("USRA"), a nonprofit corporation organized under the laws of the District of Columbia, hereby adopt the following resolution:

WHEREAS, USRA is a one hundred member university association chartered, "To constitute an entity in and by means of which universities and other research organizations may cooperate with one another, with the Government of the United States, and with other organizations toward the development of knowledge associated with space science and technology;" and

WHEREAS, the research and teaching faculty of the member universities of USRA see first-hand the decline in workforce development for space science and engineering brought on by the diminishment of hands-on, low-cost flight opportunities involving students; and

WHEREAS, the Commission on the Future of the U.S. Aerospace Industry found in 2002 that, "The nation's apathy toward developing a scientifically and technologically trained workforce is the equivalent of intellectual and industrial disarmament and is a direct threat to our nation's capability to continue as a world leader;" and

WHEREAS, the Commission on Implementation of United States Space Exploration Policy found in 2004 that, "At present, there are insufficient methods for students to acquire hands-on experience in the scientific and technical disciplines necessary for space commerce and exploration;" and

WHEREAS, the National Academies Committee on Meeting the Workforce Needs for the National Vision for Space Exploration found in 2006 that, "NASA should expand and enhance agency-wide training and mentorship programs, including opportunities for developing hands-on experience, for its most vital required skill sets, such as systems engineering;"

NOW THEREFORE, BE IT RESOLVED, that the council supports the plan outlined by the USRA Issues and Program Committee to provide multiple flight opportunities involving graduate and undergraduate students; and

RESOLVED FURTHER, that we urge the United States Government and others to implement and facilitate a plan to provide space flight opportunities that enable the hands on training for graduate and undergraduate students.

IN WITNESS WHEREOF, the members of the Council have adopted this resolution at their meeting of March 30, 2007.

UNIVERSITIES SPACE RESEARCH ASSOCIATION

W. Jeffrey Hughes
Chair, Council of Institutions

ENDNOTES

[1] USRA was incorporated in 1969 in the District of Columbia as a private, nonprofit corporation under the auspices of the National Academy of Sciences (NAS). Institutional membership in the Association has grown from 48 colleges and universities when it was founded, to the current 101 institutions. All member institutions have graduate programs in space sciences or technology.

[2] Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, Norman R. Augustine (Chair).

[3] John W. Douglass, AIA Update June/July 2007, Volume 11, No. 8.

[4] Division of Research, Evaluation, and Communication, Directorate For Education and Human Resources, Indicators of Science and Mathematics Education 1995 & The Learning Curve: What We are Discovering about US Science and Mathematics Education. Edited by Larry

E. Suter. Arlington, VA & Washington, DC: National Science Foundation, 1996 (NSF 96-52 & 53).

[5]The Learning Curve: What We are Discovering about US Science and Mathematics Education. Edited by Larry E. Suter. Arlington, VA & Washington, DC: National Science Foundation, 1996 (NSF 96-53), p 2.

[6]Harnessing Science and Technology for America's Economic Future: National and Regional Priorities, the National Academies, (1999).

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Chairman HINOJOSA. Thank you very much.

Dr. Drummond.

## STATEMENT OF DR. MARSHALL DRUMMOND, CHANCELLOR, LOS ANGELES COMMUNITY COLLEGE DISTRICT

Dr. DRUMMOND. Chairman Hinojosa, honorable members, it's a genuine pleasure to be here today.

I want to thank you specifically, and the distinguished members of the subcommittee, for the leadership each of you have provided the education community. It demonstrates your understanding of the complex issues confronting America and its role in a free world.

I especially want to thank you for the recent work you've completed to increase Pell grants and to remove tuition sensitivity, which is very, very important to Californians.

I am the chancellor of the Los Angeles Community College District. The district has nine colleges throughout the Los Angeles area, and is the largest community college district in the Nation, educating approximately 190,000 students a year.

Most of our students come from disadvantaged backgrounds and what most consider "underserved" populations. Eighty percent of our students are minorities and 40 percent live below the poverty line. All of our nine colleges are HSIs. A third of our students attend college to obtain vocational technical training and jobs, and another third transfer on to colleges and universities to obtain bachelors degrees, and on.

California community colleges are a major pipeline to California's four year colleges. Two-thirds of the California State University graduates and one-third of the University of California graduates start at a community college.

I'm here today representing the Los Angeles Community College District. However, I have a statewide perspective, having just served as chancellor of the 109 campus California community college system.

There are many outstanding programs and innovative efforts underway throughout the state to improve and expand the quality of science, technology, engineering and math education.

Sadly, insufficient numbers of public school teachers are credentialed in these disciplines and the pipeline to replace a cadre of seasoned and about-to-retire teachers isn't sufficient to meet the challenges of a prepared workforce.

California community colleges represent one of the largest potential recruitment tools for future math and science teachers. Nearly 50 percent of all the CSU teacher candidates in math and science began at California's community colleges. California community colleges are attempting to address the STEM teaching crisis by partnering with the UC's and Cal State's with a variety of innovative programs to develop highly-qualified teachers. A few notable programs include the Teacher Preparation Pipeline Project, the

SCU Mathematics and Science teacher Initiative, and MESA, Mathematics Engineering Science Achievement.

Another issue we face in the Los Angeles community colleges is that approximately 85 percent of incoming students require some form of remediation in math. This is not an indictment on public schools. However, it is a picture of the challenge ahead. The sooner innovation strategies can be implemented in the public schools and in partnership with the community colleges, the more likely the pipeline of qualified candidates for college-level math, science, and the related disciplines will increase.

Our campuses reach out to the K-12 schools. Specifically, I will speak to the Jaime Escalante program at East Los Angeles College, that uses highly-effective, innovative teaching styles to motivate inner-city youth and develop their math aptitudes.

Many of you may be familiar with the portrayal of Mr. Escalante in the motion picture Stand and Deliver. Escalante students' chances for success in college are greatly improved by the program.

Another noteworthy STEM project recently launched, is the Los Angeles Infrastructure Academy at Los Angeles Trade Technical College, just announced yesterday.

It was created in partnership with the Los Angeles community colleges, the mayor's office, the Department of Water and Power, the Los Angeles Unified School District, and Cal State Los Angeles and College of Engineering.

This innovative program for job preparation will train high school students in skills and trades and provide multiple pathways to further education and jobs.

This program hopefully addresses the 50 percent high school dropout rate, grades 9 through 12 in Los Angeles, by relating education to specific job skills, and also will help stem the need for trained labor for our public utilities.

We have over 700 openings, at the present time, in our Department of Water and Power.

As I mentioned, we spend considerable resources to remediate students in math, yet we've had great success. I am pleased to inform you that the math at Los Angeles City College ranked number one in national competition this year, and East Los Angeles College was right behind.

It's also interesting that a team of students from the Santee Learning Complex, one of the lowest-performing schools in Los Angeles, combined with students from Los Angeles Trade Tech, working with faculty from Trade Tech and Cal State LA, came in second in the world in Las Vegas, last year, in the fighting robot competition.

This clearly demonstrates to me that we have no shortage of talent in our inner city youth. We have no shortage of willingness and good ideas. What we do have is a real shortage of qualified teachers and we have a shortage of resources.

The STEM program was designed to create partnerships of excellence, and I urge you not only to fund the program, but to include in legislative language a provision that community colleges should be included in program partnerships for funding consideration as we play an integral training role in these fields.

On behalf of Los Angeles Community College District, I look forward to working with you and your colleagues to shape meaningful legislation, legislation no less fundamental to America's future than the national defense program which prepared our last generation of engineers, who, as we know, created a world-class space program and benefited a variety of U.S. industries.

I thank you very much for this opportunity and I welcome any questions you may have.

[The statement of Dr. Drummond follows:]

**Prepared Statement of Marshall E. Drummond, Chancellor, Los Angeles Community College District**

Mr. Chairman, it's a genuine pleasure to be here today. I want to thank you and the distinguished members of the subcommittee for the leadership each of you has provided the education community. It demonstrates your understanding of the complex issues confronting America and its role in a free world. I especially want to thank you for the recent work you've completed to increase PELL grants which is particularly important to Californians and for correcting the student loan program making it less expensive for students to borrow (though we all wish students would not be forced to borrow funds to further their educations).

I am the Chancellor of the Los Angeles Community College District. The district has nine colleges throughout the Los Angeles area and is largest community college district in the nation. We educate over 187,000 students each year. Many of our students come from disadvantaged backgrounds and are what most consider the "underserved" population. Eighty percent of our students are minorities and forty percent live below the poverty line. A third of our students attend our colleges to obtain job skills through career technical/vocational training and another third transfer on to colleges and universities to obtain a bachelors degree.

California Community Colleges are a major pipeline to California's public four-year colleges. Two-thirds of California State University graduates and one-third of University of California graduates start at a community college.

I am here today representing the Los Angeles Community College District; however, I have a statewide perspective having just served as Chancellor for the 109-campus California Community College System. There are many outstanding programs and innovative efforts underway throughout the state to improve and expand the quality of science, technology, engineering and math education as part of work force development but there is much more to do.

I applaud the congressional efforts to increase support for these disciplines in legislation you refer to as STEM. Each of us is aware that the economy is changing and for California to retain its economic competitiveness, job creation requires a work force equipped with skills in science, the technologies, engineering concepts, and a solid foundation in mathematics.

Sadly, insufficient numbers of public school teachers are credentialed in these disciplines and the pipeline to replace a cadre of seasoned and about to retire teachers is insufficient to meet the challenges of a prepared work force. California Community Colleges represent one of the largest potential recruitment pools for future math and science teachers in the state. Nearly half of all CSU teacher candidates in math and science begin at community colleges.

California Community Colleges are attempting to address the STEM teaching crisis by partnering with the UC's and Cal State's with a variety of innovative programs to develop highly qualified teachers. A few notable programs include the Teacher Preparation Pipeline Project, the CSU Mathematics and Science Teacher Initiative (MSTI), and MESA—Mathematics Engineering Science Achievement.

Another issue we face in the Los Angeles Community College District is that approximately eighty-five percent of incoming students require some form of remediation in math. This is not an indictment on public schools. Rather, it's a picture of the challenge ahead. The sooner intervention strategies can be implemented, in the public schools and in partnership with the community colleges, the more likely the pipeline of qualified candidates for college-level math, science, and the related disciplines will increase.

Our campuses reach out to K-12 schools. Specifically, I shall speak to the Jaime Escalante program at East Los Angeles College that uses highly effective, innovative teaching styles to motivate inner-city youth and develop their math aptitudes. Most of you may be familiar with the portrayal of Mr. Escalante in the motion picture titled Stand and Deliver. Escalante students' chances for success in college are

greatly improved by completing the program as they are better prepared for the challenges ahead of them in math, science, engineering, and technology (STEM).

Another noteworthy STEM related program recently launched is the Los Angeles Infrastructure Academy at Trade Technical College. It was created in partnership with LACCD, the Los Angeles Mayor's Office, the Department of Water and Power (DWP), Los Angeles Unified School District (LAUSD) and Cal State LA College of Engineering. This innovative job preparation program is designed to train high school juniors and seniors in the skilled trades and engineering. Not only does this program address the 50% high school drop out rate because students see how education relates to good paying jobs but also attempts to diminish the shortage of trained labor for public utilities.

As I mentioned, we spend considerable resources to remediate students in math and have had great successes. I am pleased to inform you that the Math club at Los Angeles City College ranked number one in national competition this year with East LA College right behind. There are countless other examples of successes but time limits what I can showcase today.

We ask that you support and fund programs aimed to strengthen the likelihood of student success in education. This can come in the form of Title V grants aimed at streamlined basic skills, Extended Opportunity Program and Services (EOP&S) type programs specifically aimed at STEM potentials, and scholarship or loan forgiveness programs for STEM participants.

The STEM program is designed to create partnerships of excellence and I urge you to not only fund the program, but include in legislative language, a provision that community colleges must be included in program partnerships for funding consideration as we play an integral training role in these fields.

Nowhere are the needs more pressing than in the broad array of health care services, the entertainment industry where technology is advancing at breakneck speed, and in the need to replace retiring classroom teachers. Academies which focus on science, technology, engineering, and mathematics can provide the model from which work force needs can begin to be addressed. We cannot deny the nation's security and international competitiveness are predicated on the quality and sufficient numbers of graduates in these disciplines. Again, I encourage you to further support STEM educational projects and other related funding opportunities.

As you move forward with this legislation, I am confident that you are mindful of California's and Los Angeles' changing economy and work force needs. Whether it's advanced manufacturing, the digital world, the music and movie industry, teaching, financial services, energy and its related challenges to become independent, hospitality, or bio-technology, each field requires individuals who can enter the work force prepared to move the industry forward internationally.

On behalf of the Los Angeles City College District, I look forward to working with you and your colleagues to shape meaningful legislation: legislation no less fundamental to America's future than the National Defense program which prepared our last generation of engineers who, as we know, created a world class space program and benefited a variety of U.S. industries.

Thanks you for this opportunity. I welcome any questions you might have.

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Chairman HINOJOSA. Thank you, Dr. Drummond.

Todd.

## STATEMENT OF DR. TODD ULLAH, DIRECTOR, DEPARTMENT OF SCIENCE, LOS ANGELES UNIFIED SCHOOL DISTRICT

Dr. ULLAH. Good morning, Mr. Chairman, members of the honorable committee, and panelists, for the insights they have shown so far in terms of highlighting the need for STEM education here in California and in the Nation.

I welcome the opportunity to be here today on behalf of the superintendent of schools, David L. Brewer III, and our chief instructional officer of Secondary Education, Mr. Robert Collins, and the over 750,000 kids engaged in science and mathematics education each day in our district.

This committee's work is of vital interest to the children and families of urban and rural schools throughout the Nation. It is our

belief that STEM education is critical to the national security and economic prosperity of the Nation, here, in the 21st Century.

Science and technology will be a vital part of every job and occupation in this century, for jobs that exist and jobs that are new to us in this century, and in the future.

The children occupying seats in the Nation's largest cities and schools need access and equality of opportunity regarding education in general, and STEM education in particular.

Public education must succeed in providing a rigorous, culturally relevant, comprehensive standards based education for all students in our schools.

I would also emphasize this point by indicating that we must close the achievement gap by providing sound instructional support, and again, culturally relevant strategies to the Nation's science and mathematics teachers in explicit ways to help them provide the rigorous and relevant education for learners we find in our schools today.

Our district is reaching out to make this happen every day in our schools through five guiding principles. Decision making based on data, research and analysis, professional development for all employees; promoting innovation and change within the district; engaging partners and partnering with the community; and ensuring physical and emotional safety of students on campuses.

This supports our theory of action of standards-based instructional guides, diagnostic periodic assessments given through the year, and intensive ongoing professional development for math and science teachers.

In this quest, we focus on building leadership capacity in science and math, vertically within schools, and horizontally among schools. We fully believe that developing leadership with a consistent direction within a constantly changing educational landscape is critically important.

So we focus our efforts on equity and access, and instruction in our schools. This we believe will help our district to go to scale in implementing incremental but sustained changes in teacher practices.

We believe that in order for the Nation's districts to improve public instruction and heed the recommendations and alarms of previous reports by this committee and other eminent bodies, worldwide, a series of key supports and risks must take place across the Nation.

I've outlined, in detail, my testimony for these points to follow, but I want to highlight a few things.

One. Focus on instruction. Our district is doing this with a vengeance, in terms of key initiatives in mathematics and science education. We have employed hundreds of coaches and over 1200 science lead teachers are in our schools, helping to move the initiative, and bringing science awareness to our students each and every day.

One thing critical to science instruction, I must say, is adding science to the adequate yearly progress in NCLB, so that it is tested, monitored and given the focus and attention it needs nationally.

Two. Attend to recruitment, retention, and the morale of new and experienced teachers. This is critical as we begin this work at finding high quality teachers in the United States.

Third. Implementing elementary and middle bridge programs in science and mathematics to help students with misconceptions that they have in science and math, and reaching out to parents.

Fourth. Continue building bridges with universities, businesses, the city, community, museum partnerships that support items one through three.

In this area, we have been particularly happy and pleased with our work in partnership with CSU and the community colleges in our area, to bring awareness and collaboration between our faculty members and our students.

In closing, I would like to say that this committee, and others like the National Science Board, should seek out, identify and implement effective policies that lead to increased student performance in science and mathematics. Effective policies will articulate best practices and strategies for students doing science.

Comprehensive plans for recruiting and retaining highly-qualified teachers of science and mathematics; high quality professional development; appropriate time and quality experiences for pre-K through grade 5 science instruction to meet great standards. Quality science experiences for middle school and high school students, that include field work, laboratory investigations, and linking to their cultures.

A blend of science experiences again that target and engage pre-K through 12th grade students with hands-on activities, lab investigations, field work, etcetera.

Guidelines to increase the diversity of student population in advanced science courses. Particularly in high school, we see a leak in our pipeline to colleges and universities.

We have to provide policies that look at equipment, materials, supplies, and technology necessary to support a blend of science experiences for pre-K through grade 12 students.

Appropriate classroom activities and laboratory facilities needed to maintain high quality instruction. And finally, adequate funding to support and sustain high quality science.

It has been my pleasure today to report and testify today to this committee, and I will be happy to take any questions.

[The statement of Dr. Ullah follows:]

**Prepared Statement of Todd Ullah, Ed.D., Director of Science, Los Angeles Unified School District**

I welcome the opportunity to be here today on behalf of our Superintendent of Schools David L. Brewer III and our Chief Instructional Office for Secondary Education Mr. Robert Collins and the over 750,000 kids engaged in science and mathematics education each day in our district. This Committee's work is of vital interest to the children and families of urban and rural schools throughout the nation. It is our belief that STEM education is critical to the national security and economic prosperity of the nation here in the 21st century. Science and technology will be a vital part of every job and occupation in this century for jobs that exist and those that will be new to us in the future. The children occupying seats in the nation largest cities and schools need access and equality of opportunity regarding education in general and STEM education in particular. Public education must succeed in providing a rigorous, culturally relevant, comprehensive, standards based education for all students in our schools. I would also emphasize this point by indicating that we must close the achievement gap by providing sound instructional support and cul-

turally relevant strategies to the nation's science and mathematic teachers in explicit ways to help them provide this rigorous and relevant education for learners we find in our schools today. Our district is reaching out to make this happen every day in our schools through our five guiding principles (decision-making based on data, research and analysis; professional development for all employees; promoting innovation and change within the District; engaging parents and partnering with the community; and ensuring the physical and emotional safety of students on campus) and a theory of action of standards-based instructional guides, diagnostic periodic assessments, and intensive ongoing professional development for math and science teachers. In this quest, we focus on building leadership capacity in science and math vertically within schools and horizontally among schools. We fully believe that developing leadership with a consistent direction within a constantly changing educational landscape is important. So we focus our efforts on equity and access and instruction in our schools. This we believe will help our district go to scale in implementing incremental but sustained changes in teacher practices. We believe that in order for the California districts to improve public instruction and heed the recommendations and alarms of previous reports by this committee and other eminent bodies worldwide a series of key supports and risks must take place in the nation:

1. Focus on Instruction;

• Make science an assessment component of the No Child Left Behind Adequate Yearly Progress for schools and districts to bulk up the accountability to measure science progress in our schools

• Challenge students with high expectations and give them the support to reach their potentials.

• Teach and support science at the elementary level a key to literacy and numeracy.

• Make abstract concepts in science and instruction concrete by showing teachers, administrators, and the public what it looks like in practice.

• Provide content and pedagogical professional development that focuses on inquiry based standards driven instruction that honored student prior cultural knowledge and patterns of home discourse based on language and other factors.

• Continue to use system wide as well as classroom based diagnostic periodic assessments and aim intervention at grade/credit recovery and algebra readiness. Point classroom extensions toward apprenticeship experience and connect abstract concepts in science to real world experiences and realia student are familiar with and that are engaging while strongly tied to schooling.

• Take responsibility for the public infrastructure (science facilities, professional development centers, intervention programs) that will sustain the kind of support necessary to assure that schools have access to curriculum and professional development;

• Coordinate lesson plans and instructional unit across schools and grades.

• Fund parent participation at all grade levels with innovative programs.

2. Attend to recruitment, retention, and the moral of new and experienced teachers;

• Develop and support Legislation that consistently and coherently support science teacher professional development similar to the State Reading and Mathematics initiatives. As an example, Senate Bill 960 by Senator Elaine Alquist (D-Santa Clara) has been proposed to add science to the existing high-quality professional development program for reading and math. The bill also requires the State Superintendent to convene an advisory committee to ensure the quality and effectiveness of the science professional development training. We urge the committee to support such legislation.

• Development of policies and procedures that support physical infrastructure that support rigorous, inquiry driven, standards based instruction. The number one reason science teachers leave before 5 years is inadequate science laboratories and tools.

• Resolve the complex and often challenging credential requirements as part of the highly qualified teacher component of No Child Left Behind

• Treat teachers as the trained professional educational leaders they are and seek input and collaboration on designing curriculum and pay them well. Remove the legacy culture that regards teaching as low-skill work, of a profession that has failed to develop a practice and to control entry based on the mastery of that practice.

• Focus on building leadership structures and internship opportunities that build capacity through collaboration and revitalization.

• Create greater awareness of teaching mathematics and science teaching by honoring teachers publicly.

• Support the notion and recognize efforts that engage in continuous improvement by increasing R & D. there is an R&D component to sustaining development

and support—studies of the effectiveness of various support models, development of new content and pedagogy, etc.—requires public investment (Elmore, 2006).

3. Elementary and Middle Bridge programs in science and mathematics.

• Use data to identify student misconceptions in science and mathematics and build supports around those specific concepts, attend to them using technology and other engaging strategies to plug gaps in our pipeline to high school and college.

• Study high poverty low performing districts that have transformed into high poverty high performing districts and analyze the lessons learned. El Centro School District has made claims and provides evidence that could be useful in making decisions to support science instruction.

• Public investment in summer bridge and afternoon programs for 5th and 8th graders that attend to both intervention and enrichment for students and parents.

• Fund parent programs that allow access and engagement with teachers and district leadership.

• Follow-up with high school internships and apprenticeships, particularly for high poverty, low performing campuses and communities in California.

4. Build University, Business, City, Community, and Museum partnerships that support 1-3

• Support partnership structures with institutes of higher education that focus on changing the culture of BOTH institutions so that STEM faculty see the value and expertise of leading mathematics and science teachers in our district nationwide. They will begin to refer more of there student toward careers in education and also gain a better understanding of what public school students need to know and be able to do.

• Continue to fund science partnership grants and opportunities available to both higher education and K-12 institutions to spur innovation.

• Foster and support 2-year and 4-year college articulation that helps structure alliances and collaboration in support of K-12 educational objectives.

• Support partnerships between city governments, local educational agencies, universities, and State and National Parks and Recreation programs to maximize the use of public lands and funds to advance scientific inquiry, student civic action, service learning, and parent involvement.

As indicated in the Science Framework for the 2009 National Assessment of Educational Progress developed by WestEd and the Council of Chief State School Officers:

* * * In the rapidly changing world of the 21st Century, science literacy is an essential goal for all of our nation's youth. Through science (and mathematics) education, children come to understand the world in which they live and learn to apply scientific principles in many facets of their lives. In addition, our country has an obligation to provide young people how choose to pursue careers in science, technology, (mathematics, and engineering) with a strong foundation for their post-secondary study and work experience. Our nation's future depends on scientifically literate citizens who can participate as informed members of society and a highly skilled scientific workforce-both well prepared to address challenging issues at the local, national, and global level * * *

Thank you this time to today in helping frame your work while adding our perspective from the Los Angeles Unified School District.

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Chairman HINOJOSA. Thank you, Dr. Ullah.

Now Dr. Hackwood.

## STATEMENT OF DR. SUSAN HACKWOOD, EXECUTIVE DIRECTOR, CALIFORNIA COUNCIL ON SCIENCE AND TECHNOLOGY

Dr. HACKWOOD. Chairman Hinojosa, and members of the committee, thank you very much for giving me an opportunity to talk today about some issues of science and technology, and particularly science and math teacher preparation. I will be talking from pictures. I'm an engineer, so I need pictures. You should have a copy in front of you, what I am talking from, as well as a written statement.

First of all, it was mentioned, what CCST is. We are the state equivalent of the National Research Council, or the national academies. We represent the science and technology community to the

state. We are supported by all the major academic institutions and the major federal laboratories in the state, and we work on all aspects of science and technology. Intellectual property, nanotech, biotech, all the emerging things that are affecting the state.

And I would say, without exception, ever one of our members would say that STEM education is the top on their list of important things to tackle. We also have a group of science and math teachers, because listening to what teachers say and so is very important in influencing policy. So we have a group of practicing science and math teachers that help us in all aspects of the work that we do.

Over the last year, or so, we have had an opportunity to take the report, Rising Above The Gathering Storm, which I am sure you are familiar with. Under the request of Governor Schwarzenegger, we produced a set of recommendations that are California-specific, and this was based on input directly from most of our industry base in the state, and a large number of CEOs who were involved in doing this.

And we also have a report that we did earlier on in this year, that is a critical path analysis of California's science and math teacher preparation system. This was a first real attempt at putting together the whole system, and the next picture shows this.

This, I won't go into detail; it is not the LA freeway system. It is the decision making processes that a student will go through in deciding to become a practicing teacher in the classroom. And the major message I want to give to you from this is it is immensely complex, and knowing what causes people to go in and out of the system, the flows to and from the system, is really important in any policy making, and this report does this for California. It looks at the quantity and quality of people going through the system. Next one.

Another message I want to give you is the size of the system. The system is complex. Everything you do within a system affects something up the pipe or down the pipe. But it is also a huge system. It is a system of 307,000 teachers, etcetera, and the number of science and math teachers is about 40,000. So anything that we are talking about has to have economies of scale, scaleability, and the ability to be able to survive through different political systems and through time.

Another thing that is really important is the overall percentage of teachers who are not qualified to teach in their subject area, who are teaching in the classroom, and that is exaggerated, the more you go into low-performing schools. Schools with the lowest APIs have the highest number of teachers who are not qualified to teach in their area.

The next picture shows the trends in this direction is going to get worse because of the 2000 math and science teachers who leave the workforce in California every year. That is going to get worse. We have a retirement bubble coming up through the system and our conservative estimates are that over the next 10 years, we will need 33,200 math and science teachers.

The efforts that the CSU system and the UC system have made over the last couple of years are absolutely laudable, and absolutely necessary. However, we point out that this has to be sustained, it

has to be supported, and it has to continue in order to be able to meet the needs that we have.

The next pie charts are simply to show the best estimate that we can do for the number of new hires, the new teachers going into the classroom. They are more underprepared than the teachers who are teaching in the classroom. So 54 percent of new science and teacher hires do not hold a full or preliminary credential. Next one.

It shows 66 percent of math teachers. So we may be filling the classrooms but we are filling them with teachers who are not prepared to be able to teach what they are teaching in. So next one, please.

So the key findings of our critical path analysis are that the teachers matter. We have a lack of a coherent system for measuring what is going on. We will not meet the current demand. We have attrition and retirement that have significantly affected the system.

We need to look at alternative teacher preparation systems, professional development is critically important, and the preparation, particularly in science education in elementary school teachers, is where kids get turned on in the classroom, and that really needs to have attention focused on it.

Last point. Community colleges are an extremely important player in this because we estimate that probably half of our science and math teachers come through community colleges.

So thank you very much for your work, Mr. Chairman.

[The statement of Dr. Hackwood follows:]

**Prepared Statement of Susan Hackwood, Executive Director, California Council on Science and Technology**

Chairman Hinojosa and members of the Sub-Committee, on behalf of the California Council on Science and Technology I would like to express my appreciation for the opportunity to discuss our analysis of the status of science and mathematics teacher preparation in California. California's economy depends heavily on its science and technology sectors, and it has become increasingly apparent just how much these sectors depend on science and mathematics education. This, in turn, depends to a great extent upon its science and mathematics teaching workforce. My comments today will focus on the findings of our March 2007 report, Critical Path Analysis of California's Science and Mathematics Teacher Preparation System, which was conducted in collaboration with the Center for the Future of Teaching and Learning. The report details the scope and scale of the challenges facing California's science and mathematics teaching workforce. These challenges are significant, but can, we believe, be successfully addressed given suitable focus, cooperation, and planning.

*Background on CCST*

The California Council of Science and Technology (CCST) is a nonpartisan, impartial, not-for-profit corporation established in 1988 by state legislation. It is designed to offer expert advice to the state and provide solutions to science and technology-related public policy issues. CCST is modeled in part on the National Research Council, and has developed a close working relationship with the National Academies. More than half of CCST's Members and Fellows are members of the National Academies, and several are Nobel Laureates. Since its creation, CCST has worked directly with the Governor's office, state and federal Legislators, and agencies to recommend policies that will maintain California's role as a leader in generating science and technology innovation and maintaining a vigorous economy.

CCST's sustaining institutions are the University of California system, the California State University system, California Institute of Technology, Stanford University, University of Southern California, and the California Community Colleges, as well as its affiliate members, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia/California National Laboratory, Stanford

Linear Accelerator Center, and NASA's Jet Propulsion Laboratory and Ames Research Center. CCST also has strong connections to industry through its membership and through its actions to the executive and legislative branches of government.

Recent projects have focused on STEM education, intellectual property, nanotechnology, biotechnology, transportation, energy, and climate change response.

CCST also includes the California Teacher Advisory Council (Cal TAC), modeled after the Teacher Advisory Council, established in 2002 by the National Academies. Cal TAC's goals are to disseminate public policy information from the state level to teachers, hold forums with members of the business community and provide feedback to and from the National Academies Teacher Advisory Council. Cal TAC members integrate their 'wisdom of practice' and contribute a valuable perspective to the California Council on Science and Technology education research and projects, such as the Critical Path Analysis of Science and Math Teachers.

*Science and mathematics education concerns in the Gathering Storm*

In the past several years, K-12 math and science education in the United States have been identified as an area of serious concern. The National Academies' report Rising Above the Gathering Storm (October 2005) warned that the nation was in danger of permanently losing its status as the world's economic and high-tech leader unless significant steps were taken to improve the science, technology, engineering, and mathematics (STEM) education system. The Gathering Storm's recommendations, presented in a context for California, are:

- Increase California's talent pool by vastly improving K-12 science and mathematics education.
- Ensure that California is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; and create high-paying jobs based on innovation.
- Make California the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.
- Sustain and strengthen California's commitment to long-term basic research that has the potential to be transformational to maintain the flow of ideas that fuel the economy, provide security, and enhance the quality of life.

CCST, at the Governor's request, convened four task forces chaired by corporate leaders to respond to these recommendations, and presented a list of "actionable" items with both short-term and long-term components to the Governor in December 2006. One of the four principal recommendations of the task forces was to drastically improve the recruitment, preparation, and retention of science and math teachers in California.

*The Critical Path Analysis*

While the task forces identified the challenges, there was a great deal of information about the status of the current teacher preparation system that was simply not available. The March 2007 report Critical Path Analysis of California's Science and Mathematics Teacher Preparation System provided a more detailed analysis of the situation. The project was conducted in collaboration with the Center for the Future of Teaching and Learning, and followed on CCST's previous reports, the Critical Path Analysis of California's Science and Technology Education System and the California Report on the Environment for Science and Technology.

To help frame our discussion of the system, we developed a schematic flow diagram to map pathways now available into the professional credentialed teacher workforce (the shaded diamond). It should be noted that while this figure is constructed roughly chronologically—that is, a potential teacher would move through the system from left to right—it is not strictly speaking a linear process, and many teacher begin teaching before they are fully prepared. In this diagram, the triangles are input points where different prospective teacher populations enter the teacher production system; the rectangles represent requirements that they must complete before advancing to the next stage; and the diamonds represent populations of teachers that are actually in the classroom.

The system is the largest state education system in the United States, with over 6 million students and 307,000 teachers. Of these, roughly 22,500 teachers are teaching math and 17,500 teachers are teaching science (there is some overlap between these groups). Overall, the percentage of 'underprepared' teachers in the classroom—those not holding a credential to teach their subject—constitute 6% of the teacher workforce. However, for high school science teachers, this number is 9%, and for high school math teachers, the number is 12%—twice the overall average.

And the numbers are much worse for novice teachers (those in their first or second years of teaching) and those teaching in schools with low API scores.

Normally, an estimated 2,000 teachers leave the workforce each year for a variety of reasons. However, a third of the teaching workforce is over 50, indicating that a large "bubble" of retiring teachers will significantly increase the demand for new teachers in the coming years. We estimate that, over the next ten years, California will need to hire 33,200 math and science teachers (20,000 due to normal attrition, 13,200 due to retirement).

*The scale of the problem: underprepared new hires*

As the next two figures indicate, a substantial proportion of science and mathematics teachers hired in 2004-05 were either interns (that is, full-time new teachers who are also earning their preliminary credentials) or were hired with an emergency permit. (Although the emergency permit no longer exists, districts retain the ability to fill classrooms with non-credentialed teachers where adequate supplies of credentialed teachers are not available.) In this figure, an estimated 54% of science teachers hired did not have a clear or preliminary credential.

The situation is even more serious for mathematics; here, an estimated 66% of new math teachers hired did not have a clear or preliminary credential.

Teachers have an important, proactive role to play in ensuring the delivery of high-quality science and mathematics instruction in elementary and secondary schools that serves as the building block for success in those fields in higher education and in the workplace. It simply makes sense for the state to develop and support policies that prioritize high-quality science and mathematics education for all students, particularly as the state considers strategies to avoid a predicted decline in educational attainment.

*Conclusions*

California is facing a critical challenge to produce enough fully prepared and effective science and mathematics teachers to meet the demand. Our analysis reveals the following:

- In general, California lacks a coherent system to consistently produce fully prepared teachers, especially science and math teachers.
- The state's current teacher preparation programs do not meet the current demand for fully prepared science and math teachers.
- In the next decade, California will face a shortage of fully prepared science and math teachers due to attrition and retirement.
- There is a strong trend toward alternative teacher preparation programs for prospective science and math teachers by some institutions.
- California needs more high quality professional development for science and math teachers.
- California needs to ensure that elementary school teachers are fully prepared to teach the science and math curriculum.

*Recommendations*

CCST offered recommendations for educations leaders and policymakers at every level to help address the challenges identified in this report. For state government leaders, we recommend that they:

- Support efforts to encourage teaching as a second career
- Support professional development for science and math teachers
- Establish a coherent system to recruit, prepare, assign and retain science and math teachers
- Streamline pathway for students interested in teaching science and math between community colleges, CSU, and UC
- Examine distribution of fully prepared science and math teachers

For institutions of higher education, CCST recommends that they:

- Examine teacher preparation programs to see how they can be expanded, and
- Ensure that all elementary school teachers are prepared to teach science and math.

We recommend that school districts:

- Provide adequate training for all mentors,
- Design and implement coordinated, coherent professional development programs throughout school districts, and
- Develop incentive pay systems to attract teachers to high-need schools.

Industry, federal laboratories, and informal science learning centers should expand support for professional development of science and mathematics teachers.

*The potential of the community college system*

Community colleges are a particularly important recruitment location for future science and mathematics teachers. A large number of students in teacher-preparation programs—approximately 38%—begin their undergraduate work in a community college. And we know that nearly 50% of STEM graduates from UC and CSU begin their postsecondary studies in community colleges. Both CSU and UC have made strides recently in smoothing articulation between their respective systems and the community colleges, but a great deal of unrealized potential remains.

Some studies suggest that community colleges may benefit from offering fewer, rather than more, options to their students. The proliferation of programs and pathways may lead to 'information overload', rather than an amelioration of the situation. A recent article in Issues in Science and Technology observed that "Community colleges have shockingly low degree-completion rates. In fact, many students leave with no new qualifications: no degrees and often no credits. For students who get no degree, college provides little or no labor market benefit." A systematic implementation of more stringently planned and managed pathways to baccalaureate degrees, including those leading to teaching credentials, could facilitate successful transfer rates significantly.

*Action since the release of the Critical Path Analysis*

There have been several actions this year in California meant to address the challenges identified in the Critical Path Analysis. Two bills put forth by Senator Jack Scott as the "Math Science Initiative" have been passed to make it easier for qualified professionals to enter the classroom: SB 112 exempts retired teachers who return to service from basic skills proficiency requirements and specifies that retired teachers do not need to participate in induction programs for new teachers; SB 859 authorizes the Commission on Teacher Credentialing to issue or renew visiting faculty permits authorizing instruction in math or science to individuals who satisfy specified requirements, including having a minimum of 6 years of full-time teaching experience in an accredited California community college. Other legislation passed include bills to establish a Teacher Cadet Program to recruit new teachers and to extend the Subject Matter Projects for teacher professional development. These are an encouraging beginning, but more far-reaching sustainable solutions at the right scale if impact will need to be found and implemented if California is to meet its projected need for well-prepared science and mathematics teachers.

## Secondary Math and Science Teacher Preparation in California

**Susan Hackwood**

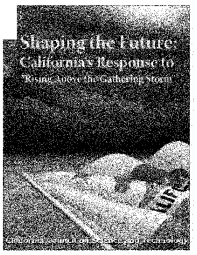
**California Council on Science and Technology**

## About CCST

- Nonpartisan, not-for-profit corporation established in 1988 by state legislation
- Designed to offer expert advice to the state government and to recommend solutions to science and technology related policy issues
- Sustaining institutions: University of California, California State University, California Community Colleges, Stanford University, University of Southern California, California Institute of Technology
- Affiliate members: Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory/California, Stanford Linear Accelerator Center, NASA Ames, Jet Propulsion Laboratory
- Work funded by state agencies, foundations, industry
- 15 Board members, 28 Council members, 120 Fellows, 12 Cal TAC
    - 6 Nobel Laureates, 79 National Academies members, 11 National Medals of Science or Technology
- Recent focus: STEM education, Intellectual Property, Nanotech, Biotech, Energy, Transportation, Health Information Technology

## Important to get teachers' voices involved in education policy

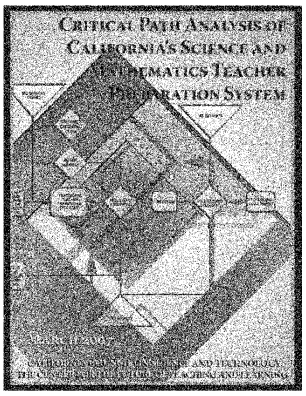
- CCST includes California Teacher Advisory Council (Cal TAC), a group of 12 master science and math teachers
- Modeled after National Academies Teacher Advisory Council
- Provide an invaluable and previously absent connection between the teaching community and the educational experts and policymakers who are shaping California's educational system




***"I would like to request that CCST use its resources - experts in all fields of science and technology who are committed to a strong and vibrant California economy - and report back to me on how the State can better understand and use the assets at its disposal to build the infrastructure needed to lead the economy of the future."***

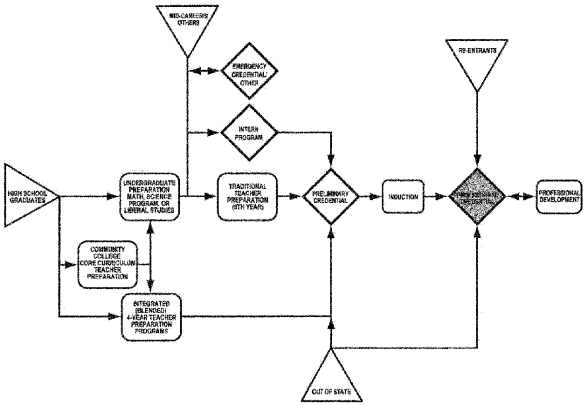
**-Governor Arnold Schwarzenegger**

**4 CEO-led Task Forces "California-ized" NA's four main recommendations**




- **Follows two previous CCST reports**
  - **California Report on the Environment for Science and Technology**
  - **Critical Path Analysis of California's Science and Technology Education System**
- **Collaboration between CCST and Center for the Future of Teaching and Learning**

**Schematic Flow Diagram of the Teacher Preparation System-- Report addresses each step in process**



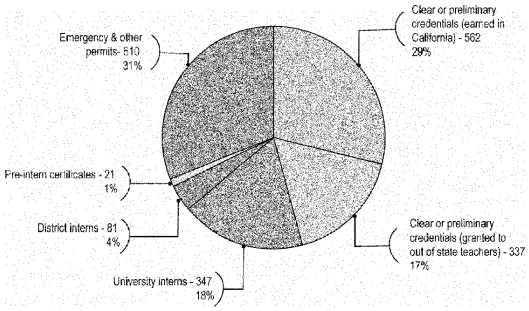

## The system overall

- **307,000 teachers, over 6 million students**
- **Roughly 22,500 teachers teaching math and 17,500 teachers teaching science**
- **Percentage of underprepared teachers overall: 6% (23% of novice teachers) *[NB: Novice teachers include first and second year teachers]***
- **Percentage of underprepared HS math: 12% (40% of novice teachers)**
- **Percentage of underprepared HS science: 9% (35% of novice teachers)**
- **Schools with most minorities have 4 times the number of underprepared math & science teachers (16% vs. 4% for math, 14% vs 3% for science)**
- **Schools with lowest API have approximately 4 times the number of underpepared math & science teachers (18% vs 5% for math, 16% vs 4% for science)**
- **12% of math teachers, 9% of science teachers are teaching out of field, irrespective of API status**

## What are the trends?

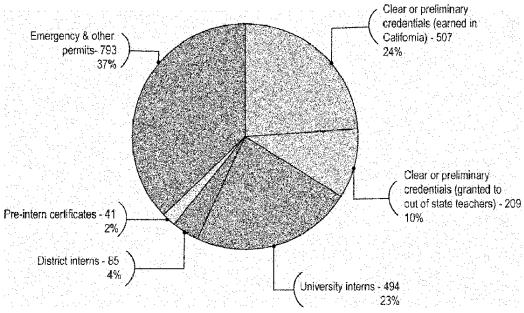
- **Roughly 2,000 math and science teachers leave the workforce each year due to normal attrition**
- **A third of CA's teachers are older than 50, half of those older than 55**
- **Conservative estimate of demand in next 10 years: 33,200 math and science teachers (20,000 due to normal attrition, 13,200 due to retirement)**
- **$50,000 in taxpayer money lost for each teacher who leaves in first five years**

## An estimated 54% of new science teacher hires do not hold a full or preliminary credential




***Estimated Number of Science Teachers Hired in 2004-05 in California, by Credential Type***
***Source: CCST, 2007***

## An estimated 66% of new math teacher hires do not hold a full or preliminary credential




***Estimated Number of Mathematics Teachers Hired in 2004-05 in California, by Credential Type***
***Source: CCST, 2007***

## Key Findings – T CPA

1. **Science and math teachers matter**
2. **CA lacks a coherent system to produce enough fully prepared science and math teachers**
3. **CA's current teacher preparation programs do not meet the current demand for fully prepared science and math teachers**
4. **In next decade, CA will face a shortage of fully prepared science and math teachers due to attrition and retirement**
5. **Strong trend toward alternative teacher preparation programs by prospective science and math teachers**
6. **CA needs more high quality professional development for science and math teachers**
7. **CA needs to examine the science and math preparation of elementary school teachers**

## Critical Path Analysis of California's Science and Mathematics Teacher Preparation System (key recommendations)

*State government*

- **Support efforts to encourage teaching as a second career**
- **Support professional development for science and math teachers**
- **Establish a coherent system to recruit, prepare, assign and retain science and math teachers**
- **Streamline pathway for students interested in teaching science and math between community colleges, CSU, and UC**
- **Examine distribution of fully prepared science and math teachers**

*Institutions of higher education*

- **Examine teacher preparation programs to see how they can be expanded**
- **Ensure that all elementary school teachers are prepared to teach science and math**

*School districts*

- **Provide adequate training for all mentors**
- **Design and implement coordinated, coherent professional development programs throughout school districts**
- **Develop incentive pay systems to attract teachers to high-need schools**

*Industry, federal laboratories, and informal science learning centers*

- **Expand support for professional development of science and mathematics teachers**

**Recruitment in Community Colleges**

- **Approximately 38% of students in teacher preparation programs begin their undergraduate work in a community college**
- **Nearly 50% of STEM graduates from UC and CSU begin their postsecondary studies in community colleges**
- **CSU: Memorandum of Understanding with CCC system to facilitate articulation**
- **UC: pilot program through California Teach initiative to identify potential science and math teachers through collaborations with community colleges**
- **Transfer students will be a key component of any new efforts to produce more science and mathematics teachers**

**Community College: The Unfinished Revolution**

*Credit: Rosenbaum, Redline & Stephan, Issues in Science and Technology*

**Enrollment and Degree Attainment Rates by College Type (N = 7,360)**

| College Type | % of Total Enrollments | Attainment Rate |
|---|---|---|
| Private, 2-year | 2% | 51% |
| Public, 2-year | 37% | 34% |
| Private, 4-year, non-profit | 19% | 79% |
| Public, 4-year | 42% | 65% |
| Total | 100% | 56% |

Note: Attainment rates refer to attainment of associate's degree or higher by 2000 by first college attended for the high-school senior class of 1992.

***"Community colleges have shockingly low degree-completion rates. In fact, many students leave with no new qualifications: no degrees and often no credits. For students who get no degree, college provides little or no labor market benefit."***

**Information Overload Versus "Package Deal" Programs**

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Chairman HINOJOSA. Thank you, Dr. Hackwood.

Each and every one of you gave excellent presentations. You certainly have stimulated my mind in what needs to be done as we approach the reauthorization of No Child Left Behind, and then, following that, a reauthorization of higher education.

I have been talking to the Chairman of the full committee which is Education and Labor. That is our good friend and colleague, George Miller, from California.

And it seems that the timeline that we have agreed to is that we should be able to finish all of our work, and pass the No Child Left Behind reauthorization, if not the last week of September, it would be the early part of October, following then the higher ed, to be fin-

ished by the first week of November, and I can see that we have lots of work.

You all have some very good recommendations that have been made, that we should try to incorporate in some form of amendments, so that we can have even better reauthorizations than we have, which are the working documents for No Child Left Behind, known as the Miller and McKeon working document, that I hope you all have received. It is on the Internet.

The one on higher ed should probably be available by the end of September.

Also, I want to ask unanimous consent that my statement, my opening statement be made part of the record. It is about seven minutes long, and I didn't want to take up those seven minutes because I wanted to give you the opportunity to speak, and those of us here, Members of Congress, to ask questions.

If there is no objection, then that will be done. My opening statement will be a part of the record.

Before I start with questions, and I am going to take five minutes, I wanted to say that I have participated in many field hearings as a member of the minority, and I have traveled, not only here in our country, but abroad. Recently, two years ago, I was invited by then-Chairman of Higher Education Committee McKeon to go to China, and to visit with seven universities that are producing the largest percentage of their engineers, scientists, mathematicians, and researchers.

And I want to share with you that what we have here in these presentations is very much like what is being done in China now. It is the implementation, and if the Federal Government could increase its investment in this area, I think that we could probably move a lost faster. It is unfortunate that we are still at war with Iraq, where we are spending $10 billion a month, and there is no light at the end of the tunnel as to when we will be able to redeploy our troops, and hopefully change our mission in Iraq.

But it is certainly one of the most important issues that we are debating in Congress and I am sure that you all are keeping up with the news, so that you would know what is happening on that issue.

But getting back to our hearing, it is important that states and Federal Governments increase their investment in education, and the State of Texas is a little smaller than California, but I would say that we are as interested in making improvements in math and science, and all of these fields that we are talking about.

And in listening to our last presenter, you reminded me of one of my five children. I have four daughters and one son. Three have graduated from the University of Texas, and the other two are young, 11 and 13. The youngest one, Karin, called last night, and let me know that she had become one of the three finalists of 22 students running for student council president. So there is supposed to be some kind of a run-off today.

But it reminded me of Karin, because I took her walking recently, and asked her what she was thinking about her career, college, what she wanted to do, and she says, Dad, I think I want to be a teacher. I said that sounds very good. Which kind of a teacher would you like to be? She said I don't want to be just a regular

teacher. I want to be a science teacher like my teacher who has a PhD in science, and has stimulated her mind like I have never seen before.

She said, But I don't want to be just a regular science teacher. I want to have a PhD and I want to teach in college. And it is amazing what a teacher at the right time can do in stimulating children's minds.

And one of you said that we just needed to pay more attention to investing more in trained, certified teachers.

Well, I am pleased to tell you that there is a bill on the president's desk, and this bill, which is entitled College Cost Reduction Act, has $20 billion, and the money is not taxes, it comes from the college student loan providers over the next five years, by taking out a lot of subsidies that they were getting, and in it, we not only address what Dr. Reed addressed, which was improving Pell grants. It is in there. Sixty percent of that 20 billion is to increase Pell grants so that they will exceed $5,000.

But there is also money to invest in training teachers, and that is something that indicates to me, that Members of Congress are paying attention to presenters like you, who are telling us to increase that funding, and that there will be opportunities to attract well-trained teachers to school districts that have a high number of families with low income, and that really need to have a lot more teachers, as prepared as you told us, Dr. Hackwood.

So I am pleased that we are going to eventually do what we should have done back in the 108th Congress, get this No Child Left Behind and higher education reauthorization done, and that you will be pleased that, definitely, there are great improvements being made, as I have seen in these last hearings.

We are going to start with questions, and I am going to ask Dr. Reed to tell me how much do you think the state and Federal Government should increase their funding for reading, for getting our children interested and excited about reading? What would it take, in investment, by the State of California and the State of Texas, and other states, as well as the Federal Government?

Because I am excited as I can be in this program that you were telling me about before we started the program, the PIQE program that you discussed with me. And what is your answer to my question?

Dr. REED. Mr. Chairman, that is a hard question about how much. Maybe one month of resources that are being spent in Iraq would be a good start. Mr. Chairman, I want to, you know, commend you and your colleagues again. Not only did you increase Pell, but as you just referred, you have put $4,000 of scholarship money per student, that wants to teach in the inner city, and that part, I commend you, and that is going to go a long way, because the numbers that I talked about of increasing math teachers, physics, and chemistry, is because California is investing in scholarships for people that want to teach, teach especially in the hard-to-work areas.

Now back up to the reading question. That is the key to everything, and if we can get children to learn to read by the end of the third grade, so many of our problems are going to go away. And when I say that, you can't do math very well if you can't read. One

of the things that we are learning, in the 11th grade test that I shared with you, it is called the Early Assessment Program, EAP, that we administer, the California State Universities, to all 11th graders that will take it, our biggest challenge in California is reading.

Approximately 80 percent of the students who take the 11th grade reading test do not achieve reading at a level that they will be successful in a university. And when I say "reading," I am going to say, very specifically, is reading comprehension. Students can read but they can't comprehend, so that they can take a paragraph or two, and then write something down, analytically, that relates to that paragraph.

So, you know, putting our emphasis in No Child Left Behind, on the reading program as the priority, is a key to the math, and it is a key to learning, it is a key to liking to learn and being more comfortable.

Chairman HINOJOSA. Your answer is excellent, because I want it to be part of the record and reasoning for an amendment that I would like to introduce before we finish No Child Left Behind. I have been in Washington 11 years, and I have been participating in a RIF program, which the acronym stands for Reading Is Fundamental, and it is a national program that has worked tremendously in the Northeast, and my two daughters have participated in it sincerely, and they have answered the question I asked you.

I said how much do you think we should invest, and how much importance should we give reading? And both Katie and Karin, 11 and 13, said, Daddy, reading is fundamental. You know that. You have been to this program, and we have been at this weekend in Washington, where I am one of the sponsors.

But the point is that if we listen to giants in education like you, and children who are in the 6th grade and 8th grade, their answer is reading, and I want to see if I can marry the program of PIQE and RIF for Texas, because we have similar statistics as California. Only 49 or 50 percent of Hispanic students and African American students are graduating from high school.

So we really need to go back, then, for children at the age of one, and two and three years of age, to begin hearing the parents, and older brothers and sisters reading to them, and getting them started, so that they can be excited about books.

So I am going to stop because I have gone over my five minutes. But I want to give time, then, to our distinguished member of Congress, Mazie Hirono, to ask her questions.

Ms. HIRONO. Thank you very much, Mr. Chairman, and everyone, thank you for being here. Aloha. Some of you have been to Hawaii, I see. I am halfway home. This trip, I won't be going home, but needless to say, I am very delighted to be here and to have the kind of presentations that you all gave. One of the major issues that we are going to be dealing with when we return—well, this is just a short weekend—but we have been working on No Child Left Behind in the Education and Labor Committee for months now.

Some of you may have been to the hearings in Washington, D.C. on No Child Left Behind. We have had over a dozen hearings. We

have received submittals from over a 100 groups and individuals on various aspects of No Child Left Behind.

And I am sure that you have some thoughts about No Child Left Behind, and what that huge federal legislation, the impact of that legislation on our schools, and in California.

I would like to start by just asking each of you if you have had a chance to review the proposed amendments, the working draft, the Miller-McKeon amendments to No Child Left Behind, and if you have any comments on those, if you have had the chance.

Have you had the opportunity to—okay. Do you have some comments, or thoughts about No Child Left Behind as it stands? I would like to hear your views.

Dr. BAKER Well, thank you, and thank you for your interest in this effort. I think it is one of the most important things that we have to do in this Nation.

In No Child Left Behind, one of the important things is a qualified teacher in every classroom, and when we think of science and mathematics, it goes beyond simply the ability of the teacher to understand the material, but how do they participate, and the ways in which they engage the students.

And I want to go back to a comment I made, and one that I have expounded on a little bit further in the written testimony.

Related to this program of teacher as scientist, to be a catalyst to help engage students in science and mathematics in the classroom, this answers two serious problems that we have with young people studying science and mathematics and choosing careers in teaching.

The first is that they always tell you, well, as a scientist I can earn more money than going into teaching. But they also tell you, and equally important is, if I go into teaching, my view is that I will stagnate and be isolated from the scientific community.

What this teacher-scientist program does is offer significant opportunities for teachers to engage in the scientific endeavors with scientists, practicing scientists, and the National Labs in California have been extraordinary in providing opportunities for teachers, in-service teachers, and we, as I said, started this year with pre-service opportunities for aspiring teachers.

We also have the private sector joining in in this, and this has been going on for 20 years, with corporations providing opportunities for teachers to work in the summer in their laboratories. And the data for 20 years has shown that the teachers who participate in these programs will be retained in the schools at twice the rate as the average teacher. So they stay there longer, and it addresses the retention issue; but it also does something else that is very important.

It brings a way of inquiry-based thinking into the classroom to engage the students. It engages the partners and creates learning communities in the schools, the partners being either the National Labs or the private sector, to help with guest speakers, to help with their laboratories, and what could be more inspiring to have a young student taught by a teacher who is also a scientist at JPL, and to go home and say, you know, Dad, my teacher knows what she is talking about cause she is a scientist at JPL as well, and I am excited about that, and I want to be a scientist.

The example. We have teachers who need to be competent, they need to be effective, but they need also be inspiring if we are going to solve this problem of getting young kids interested and excited about science.

And I mentioned this program to Secretary Spellings. She had a program of bringing into the classroom professionals, who are either early retiring, or spend part of their time, and those are effective programs as well. She recognized that this was the reverse of that in providing opportunities for teachers to go into laboratories and become part of the scientific community, and to bring that excitement of inquiry, in real time, into the classroom.

If, somehow, what you do in No Child Left Behind incorporates some incentives for that to occur, expand the programs with the National Labs and provide incentives for broader participation of our scientific corporations in this country. Thank you.

Dr. REED. Mr. Chairman, may I just comment, quickly, about reading again.

Chairman HINOJOSA. Yes, sir.

Dr. REED. I want to commend you for broadening the focus of No Child Left Behind because we don't want to leave them behind at the elementary school. The focus needs to continue about reading through the middle school and the high schools. This country does not teach reading in high schools, and i can tell you that there is a whole generation of students in all these high schools that can't read.

So if you could focus more of your reading effort on No Child Left Behind, on high school teaching reading, I think that would be a great service to this country.

Chairman HINOJOSA. The gentlewoman's time has expired, and before I recognize the next member of Congress, I want to agree with you on those last points you made, and I could add, that in the visit to China, we asked questions about their success, and they answered parental involvement from the time the child is born, and reading.

And I knew then, after that long trip that we made for about 10 days, that I would come back, and see how I could really focus like a laser, to really pay attention to those two recommendations that the Chinese gave us. But we must go on.

I would like to now recognize California, Congresswoman Grace Napolitano.

Ms. NAPOLITANO. Thank you, Mr. Chair, and to me, it is especially gratifying because I am a high school graduate, and I have no degrees and to sit here, and listen and be part of this, so exciting a panel of individuals who just "blow me away." Thank you, ladies and gentlemen.

The Chairman just touched upon it. I have been in many of the countries where education is primary. I know some of the countries are putting a lot of their time into education and into high technology, who are taking away the jobs that Americans should be doing, that we should be putting the education funding into, to be able to be competitive.

And so that just goes for the record. But we need to hear from you what must be done at every level, and I am talking about not only federal, but state, the county. How do we reach out to the

companies like Boeing and Northrop Grumman, and thank you, we had the Chair of Intelligence here last week, and he went to Boeing and Northrop Grumman, both.

And we, in speaking to the CEO of Northrop Grumman, in a specific portion that we went to, he said if the immigration laws that are in place now were in place when I came in, he is from Greece, I would not be here.

So how are we then able to help our youngsters, our students, that have such potential into being able to being the competitors that help the United States become the world power again, that it has been? Anybody.

Dr. DRUMMOND. Let me just on that point say something I think is important, that we square with, is that the real problem is not the 30 percent of the people that enter the 9th grade that go on to, eventually, to higher education and succeed. The problem is the 70 percent that don't.

In LA Unified, I don't have an exact number, I think 30 to 40 percent of the students in LA Unified are undocumented, as I understand it. In California, we are fortunate to have a law, that is not universally popular but it is very important, AB 540, which allows undocumented students to graduate from California high schools to attend either the community college or the Cal State without paying out-of-state tuition. Terribly important.

Unfortunately, those same students are not eligible for financial aid, and there has been a struggle in the state to get—Senator Cedillo has a bill called the California Dream Act. But the point being, if we continue to ignore the 70 percent of the population—and all the role models, all the people getting exposed to great scientists and such is fine—but the real point is what about those 70 percent that are not succeeding, that are on the streets?

Within a one mile radius of Los Angeles Southwest College, there are 29 operating gangs. And the answer to young people not being in gangs is hope for employment, hope for a future.

And it is very important that we build these pipelines at the grassroots level. If we don't intercede, if we don't intervene, that slide that was up there before about California leading the Nation, which isn't very pretty, in per capita income lost by 2020, a per capita income loss of perhaps as much as $2000, that will create a death spiral.

$2000 less per capita income means less income tax, and that means less resources for the higher education community and the K-12. So we begin a death spiral. We can't be the leading state in the Nation. In fact we shouldn't have any states falling off the cliff like that.

If you look at the states that aren't falling off the cliff, the question to ask is why aren't they. That is a very informative chart.

Ms. NAPOLITANO. Well, part of what you are saying, sir, is very critical for us, because statistics show that minorities, especially African American and Hispanic, have the largest dropout rates, and we are not continuing—and part of it is reading because they are not able to stay in school and be able to continue.

I have got just a very, very small amount of time to do this in, unless you are going to have a second round. But, you know, I need to ensure that not only does education reach out to other academi-

cians, but also to the business sector, and to the government sector, because without their help, we are not going to be able to make much inroad.

We are preparing people to go to work for them, and we must ask them what do they need to be able to hire the students you are preparing. And I know in some areas it has been done.

What else? How about the entertainment industry media? Because they use engineers. So do the health professions. Almost any professional. I must say, I have got to throw it in, my granddaughter is at USC in engineering school. So I am very proud of that fact. And, to me, it was something she has been dreaming of. How many youngsters that we have not reached out to have dreams but cannot afford it? My granddaughter happened to be that grandma and others kicked in to help her get to USC. She didn't qualify for any support.

But how about those that really are bright students? And I know, between us here, we can tell you individuals who have come to us at the local level and said, My daughter has graduated from whatever high school as the valedictorian, and can't go on to university.

I bet you one of us could tell you, on one hand, how many cases we have got of that.

How do we get those students to be able to succeed, and be able to help others reach that same amount? Anybody.

Dr. ULLAH. Let me respond to that for a second. In Los Angeles, as Dr. Drummond indicated, we have a lot of challenges. One of the things that we could do in NCLB is to focus on strategies in the classroom, A, with a highly-qualified teacher that knows science and mathematics, and all the supports in the system, to provide and retain those teachers. But B, to utilize and promote strategies that make science and mathematics accessible to students in our urban classrooms.

Strategies such as using graphic organizers connecting to prior knowledge.

Ms. NAPOLITANO. The Net.

Dr. ULLAH. You know, basic features of inquiry that scientists use, and making sure that those are explicit in the professional development at all levels that we are doing, both preservice and inservice, in our schools. We are focusing on that, LA Unified, this year in science education, very explicitly, strategies in Los Angeles that gear themselves towards making science accessible to English language learners, which is a critical need for our area to make students achieve.

Ms. NAPOLITANO. I am sorry. Again, I have to run through this because my mind is running. But as I am listening to the use of technology, how many of you, or do you think the high schools and the junior high schools are using technology to reach out to the Northrops and the Boeings of the world, to have scientists come online and, on site, in the schools, talk to the students and the teachers about things that will open their mind, and PIQE, their interest in science and technology.

Dr. HACKWOOD. I think you "hit the nail on the head" when you mention the entertainment industry, of getting—and a good strategy is to get the entertainment industry to encourage youngsters to go into science and technology. You know, engineering in the

city. You know, the CSI effect. The number of students who have gone into forensic science.

Numb3ers, that is on on a Friday night, that has really encouraged students to go into math.

The entertainment industry is a critical component.

Ms. NAPOLITANO. Thank you, Mr. Chair, and thank you for your answer, Dr. Hackwood.

Chairman HINOJOSA. I have decided to put in a second round of questions, and with that, I will move to Congressman Joe Baca.

Mr. BACA. Thank you very much, Mr. Chair, for having the hearing out here, and I want to thank our host, Grace Napolitano, who has always been a strong advocate, not only for the community but for education and for water issues, and many of the other issues that impact our State of California.

I also want to thank, you know, Dr. Miguel Ortiz, for hosting us here today, and his leadership that he has presented, here, at Cal Poly Pomona, because this truly is an engineering school that does a lot of the science and the math and the outreach, and many of the students that do come to this excellent campus, and thank you very much for having it here.

Having said that, I want to thank the panelists for sharing their knowledge, and their wisdom, and their concerns of what they need for the State of California, and as I heard them all, they have all said one thing. There isn't a difference between any of the six that spoke right now, that talked about funding.

So when you talk about teacher preparation, you talk about the needs in terms of the students, it all comes to funding, which is why I am really glad that we have a representative from Texas, a representative from Hawaii that is here, because you need to take a message back as well. In order to get the funding for the State of California, you need to change the formula, so California receives its first share of dollars.

That is a top priority, because when you look at the population of the State of California, we have more students in K through 12, have more students in our community colleges, and we have more students in our Cal State Universities, and we have more students in our universities than any of the other universities.

Yet, when it comes down to that formula, we are not getting our fair share. So in order to prepare our students, we need the funding, and the formula has to change, which means you guys have to change, and sometimes we all become selfish because we look out for our own states. No offense but that's true. We all do that. We are guilty of that. But we need to change that formula, if we truly want to address the needs.

And I want to ask a few of the questions that I have, because one of the things that was mentioned earlier, the need to start preparing more of our students—oh, before I do—is when you look at preparing and attracting teachers, because all of you said there is a need to have more teachers.

Well, we need to increase the salaries for teachers. If you truly want to motivate and increase, whether it's science, math, or technology, or just in the area of teaching, we need to increase the level, so this way our teachers are competitive with the private sector, because most everybody can go out there and get a job starting

at 60, 70, 80,000, or a 100 and some thousand dollars, and yet we are asking people who are dedicated, and we know that, and I think that is important. So we need to change the level.

And then also, if we look at recruiting students into our state colleges and universities, we are increasing the fees right now. That makes it a lot more difficult. And we are saying we need more students; but yet the cost continues to go up. So there is a problem there.

And I know that part of the problem that we had, we used to have partnerships between the private sector and corporate America, and corporate America is shrinking. So we don't have the kind of private participation that we have had in the past, and I will state that, because I had a program called YEMP, Youth Educational Motivational Program. It basically emphasized the importance of reading, writing, arithmetic, and it was done at the intermediate level.

Corporate America was involved. We stopped doing that. so we are not doing what we should have done because we are outsourcing and most of the jobs have left the United States.

So in reference to my question, Dr. Reed, let me ask you, that being said, everyone in the room is aware of the discrepancy in academic success that exists in minorities, in California and throughout the Nation.

In your opinion, what can we do to ensure that our English language learner students have access to math, science and technology, and education necessary to compete?

Dr. REED. Congressman Baca, that is again a very difficult question. Let me, you know, respond to your comments. Everybody has a different definition of fair. I have found that out at Congress. And you are talking about that.

One of the things in the reauthorization, though, that I know that Chairman Hinojosa and I have worried about and worked together on, and I think you as the leader of the caucus—if you can get Florida, Texas and California together, I think you can do something for the Hispanic-serving institutions that will make a big difference.

It has been done for the historic black institutions in this country, and we have got to increase the federal support for the Hispanic-serving institutions, which gets at exactly what you just said in preparing good teachers, high-performing teachers to teach reading, math, and science.

That would be a huge step in being able to do that, if you could make those changes.

Mr. BACA. I know that my time has passed but just to answer that real quick. We have got more funding for Hispanic-serving institutes in the history of the Congress, this time around, than any other time, thanks to our leader, Ruben Hinojosa, who chairs our task on not only higher education but K through 12 for Hispanic-serving institutes, and a variety of different committees.

I do agree with you, is that we need to put more money, and I do appreciate the fact that 19 out of the 23 institutions here, in the State of California, are Hispanic-serving institutes. So can you imagine, when the numbers were mentioned at community colleges, that 80 percent of the students are minorities. So they all ba-

sically, our community colleges are Hispanic-serving institutes, and we need to put in more money.

Chairman HINOJOSA. Thank you, Congressman Baca.

Dr. MARDIROSIAN. My name is Vahac Mardirosian. I was looking at the No Child Left Behind program——

Chairman HINOJOSA. Will you pause, please. You need to get to a microphone because you are not being heard. The record is not picking you up.

Dr. MARDIROSIAN. I thought I had a pretty loud voice.

Chairman HINOJOSA. I am afraid not. And after your statement, then I am going to hold all the other comments and answers to the panelists because that is the way that we have set up our hearing. With all due respect to you, I am going to let you have one minute to make your statement.

Dr. MARDIROSIAN. [off mic] Thank you. No Child Left Behind has four gradations. Basic, low basic, basic competent and advanced, and in programs is supposed to be children be graded on four levels. In math and reading. And I just happened to see what the achievement level of children in Puerto Rico was, and found that Puerto Rico, 96 percent of the children in 4th and 8th grade, 96 percent are below basic. And I just wondered who is minding the store? The only people who really would like their children to be achieving at the level where they would go to college and become engineers are the parents, and you are spending billions of dollars in a system, ignoring that the first and most important teacher in every household is a mother.

And if we were wise enough, we would spend a little bit of that money in teaching mothers what they need to do in order for their children to achieve. The United States has one fourth of the population of China. China is four times as many people as the United States. But China produces ten times more engineers than is in the United States.

Chairman HINOJOSA. I will be glad to visit with you after the hearing. Thank you very much for your statement.

I wanted to say that in 1996, when I was elected, I went to Congress wanting to see what could be done to an area where I was born and raised, that was so neglected, that not even a President would come visit us.

I found out that there was a strong movement to make English the official language, and every other language to be eliminated from all ballots, and any kind of communication to the households.

I also found out that the idea was to discontinue the Department of Education at the federal level, because those leaders wanted the education responsibility to be local and state.

So looking as a member of the local school board, I saw that 7 percent of our LEA budget came from the Federal Government. The balance came from local and state property taxes.

So when Congressman Baca was talking about getting increasing funding, and all of that, you have to understand that those are very difficult questions, when the mindset in Washington is that education, especially K-12, is the responsibility of the state.

So for us to increase funding as we have under the Reconciliation of Higher Education Act, which has—by the way, Dr. Drummond said that we needed to help HSIs and HBCUs. Well, for your infor-

mation, never in our history, since the U.S. Department of Education had Title Five, and I believe the other title for the HBCUs is seven? It is Title Three. That I got there, and they were funding HSIs with $10 million a year for all the 200 HSIs. Today, it is at 95 million through lots of effort of the Congressional Hispanic Caucus.

However, now that I am Chairman of the Higher Ed, we were able to take out of this reconciliation of the act, of $20 billion we took $500 million, and said this is going to be given, 200 million to HSIs and 200 million to HBCUs, and thanks to you, we even took a 100 million and divided it up so that Hawaiian students attending universities, and Native American predominantly controlled colleges and universities, and predominantly black colleges, would share 100 million.

All of this to say we are hearing you and we are doing something about it. But to be able to come up with 500 million over two years, not the five years of the regular act, because of my insistence that we have waited too long, and that it needed to be done now, we got the votes in the committee to spread it out over two years.

Now you just have to help us come up with a rule on how it's going to be spent, so that the biggest state, with the biggest number of HSIs, which is California, will certainly be able to qualify, because it is going to be on a competitive basis.

But Puerto Rico is also already in Washington to see how they can have input into that. So we are listening. But the Federal Government mindset has to change, and that is that we must invest more than we have in the past in the elementary and secondary education as well as higher ed.

If it were up to me, I'd make sure that we upped it to 15 percent of the local education budget. That is a substantial amount of money. I am sorry, I am not going to go into the audience because I said that I wouldn't allow another round of questions, and I am going to start with my Congresswoman Hirono.

Ms. HIRONO. Thank you. There are just so many educational reforms that states are trying, and you certainly are doing, and so many public-private partnerships that need to be encouraged and fostered.

When we look at where we should spend our resources, if resources are deemed finite, I am particularly focused on the early education part of you mentioned the importance of really hooking the students at a really young age to law, science, and math, and reading, and all those areas.

So I did want to mention that one of the changes that I hope will be made to No Child Left Behind will be support for pre-K, cause there is science and research showing that when a child goes to preschool, that child is much more prepared to succeed in kindergarten and basically all through life.

So that is a piece that is not in No Child Left Behind in any appreciable way at all. The Chairman had asked me to put together language that will provide that kind of federal support, and it is in a bill which I have introduced, along with the Chair of the committee, Chairman Miller. It is called the PRE-K Act of 2007. It is a separate bill right now. It creates a federal-state partnership with an authorized funding of a billion dollars a year for five years.

Of course the appropriators will have to decide what the level of actual funding will be.

But what it does is the Federal Government will provide grants to states, to encourage states to move toward making available quality, that is a really important adjective, quality, high quality preschool education.

And so it is to support what states are doing, not to supplant. Much of what NCLB has done is to supplant states' efforts, and that is where a lot of the criticism has come. So I hope that all of you, who are I know much more focused on the higher education side of things, that you also recognize how important it is to do some fundamental things, which is at the preschool level, and in the elementary levels, cause that is a bill that I am hoping will become a new title to No Child Left Behind, which it will be called the PRE-K Act of 2007.

So you are nodding your heads. I hope that means that you are in agreement with that kind of a prospective orientation.

Dr. REED. I am in agreement but I just want to caution. Included in that is the professional preparation of the people who work in the preschool area.

Ms. HIRONO. Oh, definitely.

Dr. REED. And it is not day care.

Ms. HIRONO. That is right.

Dr. REED. What is important is that we professionally recognize and pay these people, and they should also be educated to be able to teach these kids to learn, to learn.

Ms. HIRONO. I agree completely. That is one of the great needs for a pre-K education. That is, where do you find the qualified teachers? And so the College Reduction Act does have—we encourage those who go into that kind of education, that kind of career, as well as police officers, first responders, nurses. That they will have a loan forgiveness program, and that is one of the ways that we are attempting to address the shortage there.

Thank you. Thank you, Mr. Chairman.

Chairman HINOJOSA. I will go now to Congresswoman Grace Napolitano.

Ms. NAPOLITANO. Thank you, again, Mr. Chair, and I apologize. I wasn't here for what I hear was an interesting comment from those that feel that parents need to be brought into the picture, which is exceedingly important, and in looking at this Parent Institute for Quality Education programs, maybe we need a summit of all the programs that are out there, to explain how they are working, and be able to see how some of that assistance and funding, and maybe some of the assistance from business can help foster the growth of those. We just don't work out of the box, sometimes, and we need to think globally, who else can we bring in to help in this area?

A couple of other things. We started a program in East LA some eight years ago, that businessmen brought to my attention, that they wanted to do. Instead of giving Christmas gifts to children, Christmas toys, how about books? So what he decided—and he came to me and asked for money.

There is no money for that kind of a thing. There is just no program. So I challenged him with the professors that he brought with

him, to go back to Cal State LA, and begin to work on getting the student teachers to come in and practice at a grammar school, being able to talk to the parents who are, by the way, not English speakers, most of them, in East LA, and challenge them.

So they started a program. So now we have a program, there are schools on a waiting list, where they are going to, on Saturdays, bring the families in who signed an agreement, that they will go home and read to their children.

It is a literacy program, because now, then, the grammar school children are beginning to get the parent to say, okay, espanol and that is something, that we need to look at all the programs that are out there, that are helping us get the parents involved.

And when you talk about this, do it in languages, and not just in Spanish. But in Chinese, and other areas, where we have parents who have no concept of what is going on in the school.

So if a student doesn't give them the information, that parent doesn't know which way to point the child. But if you bring them, like Chancellor Reed, on that program you are talking about, and talk to the parents in the language they understand, they can go home and tell that child, you are going to start looking at this particular program that will put you on a career path.

It is important. We live in such a, what would I say? homogenous society, that we need to reach out to those parents, and unfortunately, in California, we have so many immigrants who have never gone to school or have low achievement in school.

How can they do something they have never been in? I was never in college until I married. Well, how could I tell my children, then, this is the path you have got to take, or should take, or must take? So we need to think other than to reach out to the populace that we serve, all of us.

Part of is maybe the universities would give credit, or assist, or find some way of being able to help volunteers who are going to be going to these programs and help it expand. We have schools on waiting lists to be able to teach literacy. Why are we not working in tandem with them, to be able to support those programs in the inner cities, in barrios, in wherever. So I am kind of just throwing it out for you.

But I have got to tell you one other thing that we are working on. I am the co-chair of the Mental Health Caucus in Washington, D.C. In working with Tim Murphy, my Republican colleague, we set out a bill that will help universities be able to deal with the issue, the Virginia Tech type, allow the university to be able to share information if they do certain things with the people involved, the parents, or the spouses of the students that you have in your school, to try to avoid another such happening.

Please look at it, and I know most of you have sent letters of support. This is key for us to be able to help you have a safe campus.

But going back to parent information, when my children, and my baby is 47, were going to school, I was told you leave the student on the sidewalk, and he goes to school, and then your responsibilities are done.

Well, that translated in my son, when he was in high school, being told by the counselor that he was not college material. Cause I didn't know how to help him.

So understand, things have evolved, changed, but you still have a lot of that mentality out there in some of your teachers, and some of those that feel that the parents' involvement is not required because you are interfering in our education curriculum.

And I am sorry to say that I still hear that from some parents. The outreach. And PT is not enough. I am sorry. You need to have more engagement with the students and the parents to be able to be more successful in bringing out those programs that are so key to getting our workforce and our students the capability of being what they can be, or must be, to help us regain our stature.

I have a whole litany. How much do I have, sir?

Chairman HINOJOSA. Thirty seconds.

Ms. NAPOLITANO. Thirty seconds. Thank you.

Dr. REED. Congresswoman Napolitano, we have printed this poster in six languages.

Chairman HINOJOSA. With Congresswoman Napolitano finishing her questions, I now move to Doc—Congressman Joe Baba.

Mr. BACA. Thank you. I appreciate the promotion, being a doctor. Maybe I will get an honorary doctorate degree.

First of all, before I ask the questions, I want to add, for the record, Dr. Barbara Flores who is the National Association for Bilingual Education, she has a set of five concerns I would like to enter for the record, if you may, Mr. Chair, accept those concerns.

And then on the panelists, I have five questions that I would like to ask, and I would like you to be as short as possible, because I want the rest of the five to try to answer the questions, and they are just going to be questions. I am not going to make a statement.

So Dr. Baker, I will start with you. In your opinion, what additional steps are necessary at the K through 12 level to ensure culturally linguistic, appropriation learning, so that California Latino students are better prepared with science, math and technology skills they need to succeed at college and at the university level, and if you can be short and brief, so the others can answer as well, additional questions.

Dr. BAKER Thank you. I think the most important thing that can be done is in schools of education, and the preparation of undergraduates for teaching, we should have significantly more effort to attract role models of people who come from those neighborhoods, and that we should provide incentives for people to go back to teach, so that they understand the people that they are working with.

That would be the best way, I think, to make progress.

Mr. BACA. Thank you. The next question is for Dr. Tarantino. In your opinion, what effects have the president's budget constraints had on NASA, educational budget, and in particular the workforce related to programs that put emphasis on careers in space science industry, and what can we do at the federal level for future alleviation of the situation?

Dr. TARANTINO. Well, it has constrained it, and I would say I really appreciate the Chairman's remark at the beginning of this about how space can inspire people to go into technology. That it is very important, and particularly when we are looking at an era of diminishing enrollments, and graduate and undergrad, higher

education in the math and sciences technologies. Our thinking with respect to space cannot be a minor part of the solution.

Mr. BACA. Thank you. Dr. Drummond, in your testimony you state that 85 percent of the students require some form of remediation in math. My question is what additional steps must we take at both the federal and local level to ensure K through 12 students have the necessary math skills to avoid the kind of remediation when they move into higher education? And you mentioned that about getting into colleges.

Dr. DRUMMOND. Yes. Let me first thank you all for your attention to TRIO, and EOP&S. It is interesting that EOP&S deals with students who come in with lower scores and capabilities but have a higher graduation rate. I don't want to lose the great importance of the program.

To answer your question, I believe we have to really focus on the pipeline issues. You know, I ran marathons for many years, and one thing you don't do when you run marathons is look at the 26 mile marker at the end. You look at the next mile marker, because you get pretty discouraged if you look 26 miles out.

The point is that if we go tell people, you know, your goal is to be a PhD, or be this or that, an awful lot of these students, the 70 percent that go nowhere get very discouraged and can't see that far ahead. So it is a pipeline issue.

It is very important community colleges work with the middle schools and the high schools. It is very important the CSUs are right along with us. And some of the grants I talked about, the Heinecke grant, a new development in Los Angeles called READY, an initiative, all involving those partners, so that we are reaching into the middle schools, and we are giving the kids not only an idea of the next step but we are giving them support.

We are helping the faculty in the middle schools. We are all working together. Cal State faculty helping ours, ours helping them, them helping us. It is really a conversation. These are not silos. These young people have to move through these pipelines. And so any programs that encourage that sort of partnership are very positive and very powerful, and Title Five can certainly be one vehicle for that.

Mr. BACA. Okay. Thank you. We all know that difficulties can be to have proper resources in our schools in the major urban areas like LA. We know that overcrowding of our schools is almost a major deterrent in school achievement.

In your professional experience, how much of the difference would smaller classrooms in science and math make in student achievement?

Dr. ULLAH. The research on that is still out in terms of smaller class size and effective student achievement. But in my view, I think that if we reduce class sizes in science and mathematics, as there are bills, for instance, our 1133 bill here in California is reducing mathematics and science classrooms in the country.

Again, personalization of the environment to kids in our schools is also important as you reduce class size. So I would say personalization, along with reduced class size, and as our colleagues have said, you know, preparation for teachers to work with students in our areas is key.

Mr. BACA. I have got one more question. Dr. Hackwood, I represent a district that has close to 70 percent Latino population. This is a statistic that is quite troubling to me. What kind of incentives do you think are necessary to attract more qualified teachers to each in the underprivileged and high minority areas?

Dr. HACKWOOD. I think the most important thing is to professionalize the discipline of teaching, to recognize that teachers are professionals. They are doing an extremely important job, and the support of teachers, and through professional development, for example, the kinds of programs that you have heard about with the federal laboratories, a connection to the universities so that the teachers can feel part of the science and technology community.

Salary is an issue but it's not as much an issue as the support and professionalization of the teaching career, and to get teachers teaching in the geographic areas where they represent the same population that they came from.

Mr. BACA. Okay. I know that my time has run out, but Congresswoman Hirono asked an important question about the Leave No Child Behind Act, and as we look at the Leave No Child Behind Act, what effects does overcrowdedness have in terms of learning behavior and the evaluation of teachers? Because I believe that our teachers are getting a "bad rap" with overcrowded classrooms in the State of California compared to other states, too, as well.

Would anybody like to elaborate on that?

Dr. ULLAH. I would like to say one thing about overcrowded schools. In Los Angeles, many of our schools are on year-round calendars, and these year-round calendars and multi-track schools are a result of not having enough facilities and qualified people to run them.

So as a result, you have some deleterious effects on student learning and teacher morale related to schools operating around a year-round calendar.

So any support, policies, at the state, federal, county levels of support, facilities construction, and again, teacher preparation, are going to be key to helping kids and teachers have learning environments that would help the process.

Chairman HINOJOSA. I want to thank my colleagues and members of Congress for participating today and for asking your questions. It raised the quality of our hearing. I messed up my five minutes of asking questions but I want to make closing statements, and I am going to ask this one last question of Dr. Hackwood.

There is a national controversy as to whether the National Council on Accreditation of Teacher Education, or some alternative accreditation, should play the major role in addressing the problem that you were addressing.

What is your perspective regarding alternative teacher preparation programs for math and science teachers and the accreditation of those programs?

Dr. HACKWOOD. Alternative teacher preparation programs are very important, and the data that we have show that a significant fraction of teachers come through that program. The various programs. You saw the complexity of the wiring diagram I showed. So if you remove those ways of getting into the teaching profession,

you will exacerbate the problem. You will make the problem much worse.

The question I think you are asking is on measuring the quality and the performance of the teacher, so that you have the right type of person teaching in the classroom, with the right pedagogy and the right support to be able to teach what they are teaching.

I think that is a much more fundamental issue to ask, and comparing credentialing programs——

Mr. BACA. So how should we address that?

Dr. HACKWOOD. By comparing credentialing programs and looking what the pedagogy is. What ammunition are we giving teachers to go and teach in the classroom?

Chairman HINOJOSA. Well, I thank you. This has been very interesting, and in my closing remarks, I would like to thank our hosts for today's hearing, California State Polytechnic University at Pomona.

I also wish to thank President Michael Ortiz and his staff for working with ours in Washington to make this hearing as interesting as it has been.

I thank everyone for providing this wonderful venue, and for the kind hospitality given to those of us who came from Washington. We thank you, and this hearing is ended.

[Whereupon, at 11:20 a.m., the subcommittee was adjourned.]

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