Learning Subgroup

The Committee concluded that there has been significant achievement for the Learning outcome goal.

Introduction

The Learning Subgroup of the Advisory Committee for GPRA Performance Assessment was charged with the task of assessing whether the NSF has demonstrated significant achievement for the Learning goal outlined in the NSF Strategic Plan (2006-2011) to "cultivate a world-class, broadly inclusive science and engineering work force, and expand the scientific literacy of all citizens"

Subgroup Members:

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Process Followed and Criteria Used

The subgroup members read and analyzed 261 highlights classified under the Learning outcome goal. Each member of the subgroup reviewed approximately 65 highlights.

The Subgroup was asked to review and evaluate the accomplishments against one or more of the following criteria:

K-12 Education and Teacher Training

- Support research to improve the education of K-12 students in science and mathematics
- Support education research that develops successful models for K-12 teaching and learning
- Support active involvement of K-12 teachers in NSF-funded research and workshops to bring fundamental knowledge and technological innovations into their classrooms

Undergraduate through Postdoctoral Training

- Prepare and support the next generation of STEM professionals and attract and retain more Americans to STEM careers.

- Support active research participation by undergraduate students in NSF-funded projects.
- Support active research participation by graduate students in NSF-funded projects.
- Support community college faculty in NSF-funded research to bring fundamental knowledge and technological innovation into their classrooms
- Broaden the participation of individuals and groups that are underrepresented in STEM and diverse institutions throughout the United States in NSF-supported research and education activities and programs.

Public Understanding of STEM and Lifelong Learning

- Increase interest, engagement, and understanding of STEM by individuals of all ages and backgrounds and within a variety of different formal and informal educational settings that contribute to lifelong learning.
- Prepare and support the next generation of STEM professionals and attract and retain more Americans to STEM careers.

Based on the review of the accomplishments against the above goals, each member selected about five highlights that she or he believed are the best examples of NSF's achievement of the Learning Outcome Goal. Subgroup members were asked to be reflective about the rationale behind the choice of selected highlights. They were also encouraged to identify any themes or threads that run through the highlights they chose.

In addition, NSF staff members were asked to provide the subgroup with various statistical breakdowns of highlights. Variables analyzed included: number of categories chosen, most commonly selected categories, category combinations for all selected highlights, and highlights by Transformative Research, Broadening Participation, and Benefits Society. These data helped to provide a fuller picture of the highlights and identify common themes.

Analysis Overview

Accomplishing NSF's Strategic Outcome Goal for Learning: to "*cultivate a world-class, broadly inclusive science and engineering work force, and expand the scientific literacy of all citizens* " is crucial to the future of science and democracy itself. The Foundation has invested resources in programs across the various directorates designed to strengthen learning through advances in K-12 Education and Teacher Training, Undergraduate through Postdoctoral Training, and Public Understanding of STEM and Lifelong Learning. Importantly, NSF has made broadening participation of previously underrepresented groups such as women and historically

underrepresented minorities in STEM fields a significant component of its work to accomplish the Strategic Outcome Goal for Learning.

NSF has also made a commitment to integrate research with education, which is a cornerstone for effective learning across all levels of schooling. This commitment is highlighted in the "Translating the Plan into Action" section of Investing in America's Future (NSF Strategic Plan FY 2006-2011) under the heading *Integration of Research with Education*: "Strengthen connections between learning and inquiry. Deciding factors include whether investments present a rich environment for encouraging future scientists, engineers, and educators, and whether they provide opportunities for teachers and students to participate in research activities at the K-12, undergraduate, graduate, and postdoctoral levels."

A component of its commitment to integrate research with education is the Foundation's identification of "discovery-based learning" as a particularly effective means to increase the effectiveness of math and science education. This approach is discussed in the "Introduction" section of the Strategic Plan: "Discovery-based learning–from hands-on activities in kindergarten to public participation in research sample collection—is becoming an integral feature of formal and informal education at all levels. As new practices take root they are transforming education research and practice in ways that are not yet well understood."

Central to NSF's success is its merit review system for review, assessment, and selection of projects. Two criteria are utilized in the merit review: intellectual merit and broader impacts. The criterion of broader impacts has significant implications for the Strategic Outcome Goal for Learning, as well as the variety of means and indicators of accomplishing that goal. According to the Strategic Plan: learning itself, the integration of research and education, and broadening participation are components of broader impacts: "Broader impacts include aspects of teaching, and learning, integration of research and education, technology transfer, societal benefits, technological innovation, infrastructure development, and opportunities to include a diversity of participants, particularly from underrepresented groups in science."

The subgroup selected highlights that are components of broader impacts, involving active, hands-on, discovery-based learning; the integration of research with education; and broadening participation. The broadening participation category was represented in every selected highlight; benefits society in 20 of 22. Fifteen of the twenty-two selected highlights demonstrated significant achievement in more than one research and education outcome and evaluation criteria. In fact, 12 involved from 3 to 6 research and education outcomes and evaluation criteria. A significant number (15) and percentage (68%) of projects involved K-12 students and/or teachers; an equal number and percentage also involved a focus on

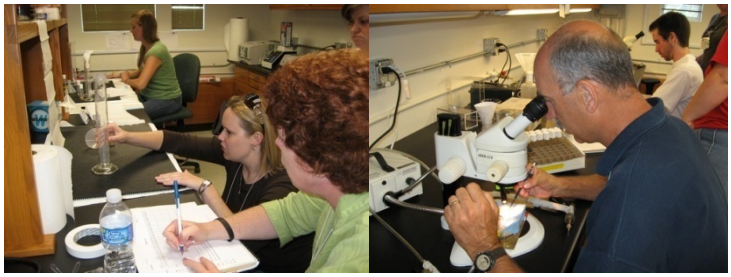
undergraduate through graduate research. Ten (45%) involved programs across a continuum of schooling, joining K-12 and higher education. This finding led the Subgroup to develop an additional criterion: P-20 Plus: Integrating PreK-12 Education through Higher Education.

Integration of research with education, connecting projects across levels of schooling, and combining a number of research and education outcomes and evaluation criteria are among the most impressive strengths of NSF's work to accomplish its Strategic Outcome Goal for Learning. This emphasis on integration, broadening participation, and broader impacts denotes a powerful approach to advancing learning; increasing the public's interest, engagement, and understanding of STEM; and producing positive societal impacts, including sustainable institutional change of K-12 and higher education.

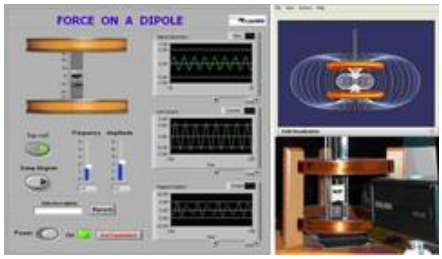
The subgroup selected the following highlights as examples of significant achievements in the area of Learning:

K-12 Education and Teacher Training

These projects emphasize meaningful, contextualized STEM teaching and learning that pose real-world, hands-on, interdisciplinary, project-based problems. One major outcome of such an emphasis on context is that solutions to these problems often involve those who live in developing countries and/or in underserved communities. For example, the ***Elementary School Teachers'*** project (*Highlight 17025, Award 0822236)* involves innovative, hands-on science education. Faculty members and lab personnel from the University of Oklahoma work as facilitators, encouraging elementary school teachers to conduct their own research, raising questions, developing hypotheses, and testing them without prior knowledge of the field (biology of the fruit fly). The project involves a summer science camp for the teachers, and it has been expanded to sixth graders, engaging them in hands-on experience with brain research. Teachers and students learn science by doing science. They develop an interest in scientific work through active engagement in the scientific process of discovery. This work, done in an EPSCoR state (Oklahoma), highlights broadening participation, as well as broader impacts, by providing a replicable approach for science education and university collaboration with pre-K to 12 education. In another example, ***Rollercoaster Fun!*** *(Highlight 17417, Award 0808107*)



researchers at North Carolina State University have partnered with North Carolina's New Schools Project, Elizabeth City State University (a Historically Black College and University), and two diverse high schools to actively engage high school students in engineering, mathematics, and science through a hands-on, interdisciplinary, real-world approach of studying the motion of rollercoasters.



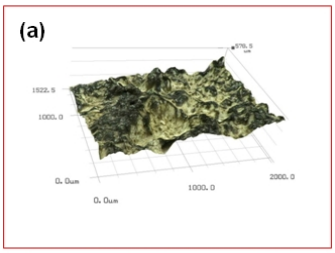
In ***CI-TEAM Implementation Project - The iLab Network: Broadening Access to Hands-on STEM Learning via Remote Online Laboratories*** (*Highlight 19220, Award 0753324*), the Massachusetts Institute of Technology and Northwestern University have collaborated with the Chicago Public Schools and online schools to provide a remote laboratory cyberinfrastructure for STEM education that will offer access to real experimental devices. While virtual (and therefore not "hands-on"), the project still has great potential to enhance users' access to laboratory devices in real time, thus improving high school curricula and laboratory experiences for students and teachers, particularly those in schools located in low-income areas. Furthermore, the free nature of the remote laboratory encourages wide public use in informal settings such as science museums. These wide-reaching, informal educational tools are likely to contribute to deeper, lifelong learning and appreciation of STEM and may attract and retain more Americans to STEM careers.

Undergraduate through Postdoctoral Training

Two projects involve the successful integration of research and education. ***The Florida International University Center for Research Excellence in Science and Technology*** *(Highlight 17776, Awards 0317692 and 0833093)* has implemented synergistic research and education activities that have substantially increased the number of underrepresented students pursuing doctoral degrees in computer science in the United States. FIU CREST has graduated 39 Ph.D. students in computer science and computer engineering. Of these, 33 percent have been underrepresented minorities and 38 percent have been women. In fact, FIU soon expects the CREST-induced enrollment diversity to result in four Hispanic Ph.D. graduates in computer science per year, compared to approximately 10 Hispanic PhD graduates per year nationally. This initiative is significantly broadening participation, an important NSF theme, in computer science. As a result of this grant, FIU has institutionalized changes in training and involving studentsin research. The program has used NSF funding as a bootstrap to attract additional support, including support from other NSF directorates, as well

as synergistic collaborations with other partners. Lastly, FIU CREST is tracking the participation of students in an effort to assess its success in maintaining and graduating a diverse cohort.

The Scout Robotics Platform Advance and Reinvigorates Computer Science Enrollment *(Highlight 17900, Awards 0420836 and 0531859)* developed software for the Scout robotics platform with an emphasis on search and rescue operations while at the same time developing an excellent educational tool for students who are learning to work with robotics. Berea College has put it to use in the entry-level Introduction to Robotics course. Computer science enrollments at Berea have doubled due in part to the implementation of this entry-level course and to undergraduate research opportunities in robotics as part of this project. Other colleges are exploring the possibility of using this curriculum in their introductory courses. Another excellent example of a project that integrates research with education is ***Water Treatment*** *(Highlight 18090, Award 0404874)*. In this project undergraduates at the University of Pittsburgh, seven of whom are racial/ethnic underrepresented minorities, in collaboration with UNICAMP University in Brazil have conducted interdisciplinary research to develop and test an effective model of a low-cost, ceramic water filter that would enable cleaner drinking water and better sanitation, thus yielding a higher standard of living in Brazil and in other developing countries. Students, particularly those from underrepresented populations in STEM, are more attracted to, and retained in, STEM if their studies and research have social meaning and real, immediate impact.



A program that has demonstrated tremendous overall success is the ***Alliance for Graduate Education and the Professoriate (AGEP) Broadens Participation among the Nation's Faculty*** *(Highlight 19019, Award 0823766)*. AGEP institutions report increasing enrollments, high retention, increasing Ph.D. graduations, and successful transitioning of Ph.D.s into the workplace. The AGEP at Georgia Tech is noted as one of the top producers of engineering and science doctorates for underrepresented minorities and ranks number one in engineering doctoral degrees awarded to African-Americans and number 3 in those awarded in all categories to minority students. In the past 3 years (2005-2007), the Facilitating Academic Careers in Engineering and Science (FACES) AGEP has produced 77 Ph.D.s from underrepresented groups. FACES is a collaboration among Emory

University, Morehouse College, Spelman College, and Georgia Tech and assists underrepresented engineering and science students with navigating the path to an academic career. This stellar NSF program demonstrates the effectiveness of collaborations and the importance of support programs beginning early in the academic pathway and remaining along the continuum even after the initial academic appointment. The AGEP at Georgia Tech has successfully addressed NSF evaluation criteria of supporting the next generation of STEM professionals, attracting and retaining more Americans in STEM fields, supporting undergraduate and graduate students in NSF funded research programs, broadening the impact of science, and broadening the participation of underrepresented groups in STEM careers and NSF supported programs.

Public Understanding of STEM and Lifelong Learning

Another major outcome of real-world, contextualized STEM teaching and learning is effectiveness in increasing the public's interest, engagement, and understanding of STEM. For example, Elizabeth Hausler, a civil engineering graduate student at the University of California at Berkeley ***"Build Change" Exports Earthquake Engineering Techniques to Developing World*** *(Highlight 17865, Award 9701568)* has founded a worldwide non-profit organization whose members travel to developing countries that are prone to earthquakes and teach residents how to build low-cost, earthquake-resistant housing, using locally available materials and tools. In another example, Public Broadcasting System (PBS) has developed Season 3 of ***Design Squad: Inspiring a New Generation of Engineers*** *(Highlight 18166, Award 0810996)*, a reality series featuring two teams of kids competing to solve hands-on engineering problems. The program, which has engaged nearly 95,000 children and families, has an accompanying outreach campaign (282 events around the country) and active website. Evaluation has found that the program has increased kids' knowledge of engineering, challenged their negative stereotypes of engineering, engaged a significant proportion of girls and minorities, and improved the public image of engineering as a discipline that helps to improve lives and affects real people.

FETCH! Increases Children's Knowledge of Science Careers *(Highlight 18169, Award 0714741)* uses a large scale approach to address the issues of increasing the numbers and broadening participation in science. FETCH! is a children's television series airing nationally on PBS with approximately 3.5 million viewers weekly on 325 PBS stations. FETCH! has done a particularly good job at evaluation using the Goodman Research Group. Fourth-graders who watched

FETCH! made significant gains in their understanding of science content, ability to apply content to new situations, and recognition of science and engineering process skills. In the third season, the FETCH! production team made changes to the production model in order to emphasize science careers. This, too, has made an impact. Fourth-grade students who watched 5 episodes of FETCH! showed significant increases in their scores on questions related to science careers. Specifically, students were better able to describe what scientists do, give less stereotypical answers to questions that asked about scientists' work habits and settings, and broadened their ideas about what constitutes a science career. The target audience of 6- to 10-year olds is significant in that most outreach is done with older audiences. In addition to the television program, FETCH! Outreach serves an estimated 680,000 kids through partnerships with museums, libraries, and afterschool groups. The FETCH! Web site draws about 18,000 visitors a day. FETCH! makes special efforts to reach out to underserved audiences with the result that there are an equal number of girls and boys watching the show, and 43% of the viewers are African American or Hispanic. This model, which sparks an interest and understanding in science and science careers, has the capacity to transform an entire generation of youth to the fun and excitement of STEM fields.

ATE-Sponsored Wind Energy Project Trains Turbine Technicians *(Highlight 19102, Award 0801212)* is an Advanced Technological Education (ATE) program at Laramie County Community College (LCCC) in Wyoming that will train and educate technicians who will service wind turbines. As wind energy becomes a key source of renewable energy, more and more wind turbines will be needed. (The PI notes that 3,200 new wind turbines were installed across the nation during the last year.) The LCCC program centers on designing and implementing career pathways in wind energy technology by developing wind energy certification, diploma, and associate degree programs and community information seminars/workshops on wind energy technology and related renewable energy topics. This program supports community college faculty in providing fundamental knowledge and technological innovation into their classrooms, broadening impacts as trained LCCC students potentially can provide services to a variety of other geographic locales, attracting more Americans to STEM careers, and increasing the understanding of renewable energy topics to community groups.

P-20 Plus: Integrating PreK-12 Education through Higher Education

This category includes highlights that successfully integrate the research and education outcomes of **K-12 Education and Teacher Training** and **Undergraduate through Postdoctoral Training.** In addition to successfully integrating these two outcomes, a number of highlights also involve significant achievement in **Public Understanding of STEM and Lifelong Learning.**

The highlight titled ***From Television to Local Schools: NSF PI is Making a Difference*** *(Highlight 17445, Award 0615154)* provides an excellent example of P-20 Plus achievements. This highlight illustrates how the outreach activities led by Dr. Anne Simon, a NSF supported plant virologist and consultant for X-Files TV programs and movies, have led to improved student biology performance as well as increased teacher understanding of science and delivery of information to students at Duval High School (98 percent minority and low achieving) in Prince Georges County (PGC), Maryland. Dr. Simon, author of The Real Science Behind the X-files (2001, Touchstone Press), has used her ability to effectively interest and engage the general public in scientific issues to engage and teach students and teachers. She also presents a positive image of what science is and how it is done. Dr. Simon's outreach efforts, which have included teacher training, weekly sessions with Advanced Placement biology students, and pairing University of Maryland graduate students with students for after school tutoring, resulted in student biology assessment scores increasing by 42 percent (from 2005-2006) at this school. Subsequently, Dr. Simon received an NSF grant to conduct a summer workshop for all PGC teachers. The year after teachers completed the workshop, the same cohort of Duvall students' scores increased by 66 percent (overall) in 2007. This success led PGC administrators to continue the program in 2007 and expand its focus on improving science teaching in PGC K-12 schools by agreeing to participate in a 5 year, $12.5 million NSF Math and Science Partnership Program grant in partnership with the University of Maryland and other local institutions of higher learning.

Developing the Scientist of the Future *(Highlight 17535, Award 0710709),* a project located at the University of Richmond, involves teams of university students and high school students and teachers doing research on how the brain works. The project involves significant team building activities in order to help create an integrated research team. All three groups learn about science through research-based inquiry, and high school teachers receive valuable assistance in their classrooms since undergraduates also work as science tutors. Undergraduates not only learn about science through teaching science, they also learn how to

teach. The program highlights broadening participation since it involves minority students in the greater Richmond area. The project is of significant societal benefit since it provides a replicable approach for effective STEM education across all levels of schooling.

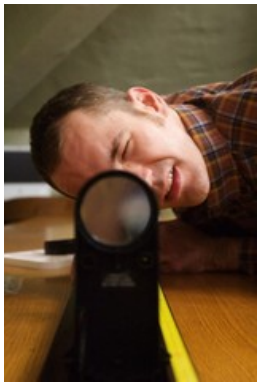
The Future Scholars Program Introduces Young Students to the Pharma Field *(Highlight 18029, Award 0540855)* is also an excellent example of increasing and broadening participation. NSF's Center for Structured Organic Particulate Systems, which is headquartered at Rutgers University, works with the Rutgers Future Scholars Program, an unusually intensive outreach program aimed at disadvantaged populations. This multi-year program provides opportunities for education, growth, and enrichment, exposing students to career paths they may not have thought possible. Particularly interesting components are the development of a Parent Learning Community and the promise of four years of tuition and fees for Future Scholars who meet admission requirements and choose to attend Rutgers.

More Scientists and Stronger Materials in Our Future *(Highlight 18092, Awards 0547976 and 0606040)* is a particularly innovative project, involving 6 research and education outcomes and evaluation criteria. Working with the Harlem Children's Zone, an extraordinarily influential school and community improvement program, a Cornell Professor, Itai Cohen, brings hands-on science to at-risk youth in Central Harlem. This project involves first grade students with the field of materials science through exploring the characteristics of everyday and unusual materials. The project is linked with Professor Cohen's research on understanding materials properties by means of experimentation with colloidal materials. Connecting a major research project with a highly successful community program and outreach efforts to school children is extraordinarily innovative, creative, and significant. The project offers a model for integrating frontier research with frontier educational and community outreach involving STEM and underrepresented minorities. This work could well result in new materials for everyday applications, as well as a replicable approach for STEM education and strengthening STEM pathways.

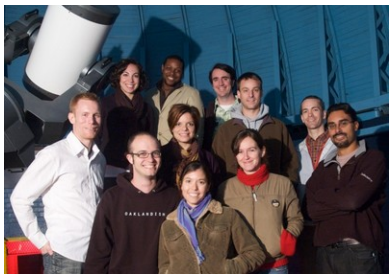
Creating K-12 Teacher and Counselor Leaders in Biotechnology *(Highlight 18368, Award 0757292)* is conducted by the Biotechnology Education Infusion (BEI) project. BEI is a multiphase Northwest Regional project funded by NSF's Advanced Technological Education (ATE) program and a collaboration among Washington State University (WSU), Spokane

Community College, and Eastern State University with significant participation of regional biotechnology industry and research institutes at WSU. BEI is designed to provide laboratory instruction, mentoring, and material support to 90 teachers and counselors to help better inform and prepare students for biotechnology fields. This program is significant because only 35 percent of the entering teachers and none of the counselors were aware of biotechnology careers prior to beginning the BEI program. Additionally, at the beginning of the BEI program, less than a third of teachers reported ever having worked with counselors. As a result of the BEI program, teachers and counselors gained sustained awareness of biotechnology careers and began working together. There is now more in-depth student counseling related to biotechnology careers and greater use of biotechnology labs by several thousand students each year in middle, high school, and community college science courses throughout Washington, Montana, Idaho, and Oregon (representing 38 urban, suburban, and rural schools). Given teachers' and counselors' lack of biotechnology knowledge, this represents an extremely important program for ensuring that a broad number of students in a wide geographic area gain information in biotechnology instruction and biotechnology careers and demonstrates the importance and significance of collaborations. It also supports the involvement of K-12 teachers in workshops to bring fundamental knowledge and technological innovations into their classrooms, improving the education of K-12 students in science and math and broadening the participation of underrepresented groups (over half of participating schools have significant high-needs and minority student populations and one BEI school is on an American Indian reservation).

Marcel Agueros, an NSF Postdoctoral Fellow who is a member of an underrepresented minority group, has developed a research and professional development program in New York City.



New York City Science Teachers Observe Variable Stars from the Rooftops *(Highlight 18634, Award 0602099)* brings culturally diverse cohorts of public high school teachers (and NSF-funded graduate students) to the rooftops of buildings in urban neighborhoods, the contexts in which they live and work, to participate in authentic astronomy research: observing low-mass flare stars. Teachers then bring new research methods, astronomy knowledge, renewed enthusiasm for science, and knowledge about technological innovations back into STEM classrooms. This collection of projects underscores the importance of teacher *leadership* development as well as the paramount importance of collaborations across levels (i.e., high school, college, graduate school), professional roles, and institutions in attracting and retaining more young Americans, particularly those who are underrepresented.



Collaborative Research: BPC-DP: Improving Minority Student Participation in the Computing Career Pipeline with Culturally Situated Design Tools *(Highlight 18954, Awards 0634342 and 0634461)* Rensselaer Polytechnic University, Texas A&M, and University of North Carolina, Charlotte have established a collaboration of university faculty, teachers, and community partners to develop, evaluate, and implement "Culturally Situated Design Tools" (CSDTs). Based on the concept of ethnomathematics, CSDTs relay the mathematical knowledge embedded in cultural designs such as Native American beadwork and Latino percussion rhythms. CSDTs were integrated into standardized curricula in inner-city schools (grades 3-12) with large populations of African-American, Latino, and Native Americans in seven states throughout the country. Preliminary evaluations indicated statistically significant increases in kids' mathematics achievement and attitudes towards technology-related careers, thus indicating a successful model for K-12 teaching and learning.

PIRE: A Global Living Laboratory for Cyberinfrastructure Application Enablement *(Highlight 19251, Award 0730065),* which involves Florida International University/Florida Atlantic University (FIU/FAU) in a Partnership for International Research and Education (PIRE) project, is a research effort that focuses on developing cutting edge science and technology to use the Internet to address critical societal problems (e.g., disaster management, healthcare, energy efficient buildings, etc.) in the United States and around the world. Seven international institutions in Mexico, China, Spain, India, and Argentina to include industry research labs and national supercomputing centers, 18 FIU/FAU BS, MS, and PhD students and 28 faculty and scientists from partner institutions form this consortium. As an innovative global living laboratory, this consortium allows for a multitude of collaborative research studies that will be able to take advantage of existing and developing cyberinfrastructure to access large data bases through grid technology. PIRE represents an excellent model for enhancing international research opportunities for students and investigators and helps to strengthen U.S. leadership in sustainable global partnerships and innovations. This program prepares the next generation of STEM professionals, supports research participation of undergraduate and graduate students in NSF-funded research projects, and broadens the impact of NSF funded research. Additionally, the PIRE program illustrates how to apply cyberinfrastructure to advance the understanding of global issues and provide more authentic and motivational STEM learning opportunities for students.

Updating Understandings of Gender and Mathematics Performance *(Highlight 19311, Award 0635444)* provides the research underpinnings necessary to increase the number of girls and women potentially entering STEM education and careers. These NSF funded researchers have analyzed mathematics standardized test results for over seven million students in grades 2 through 11. Their analyses of state assessments of cognitive performance from ten states indicate no gender difference in average mathematics performance. These findings refute common stereotypes that girls lack mathematical ability and that boys are better at math than girls.

Involving a partnership among Salish Kootenai College, Montana State University, University of Montana, 30 K-8 schools and consultants form Crow, Flathead, and Northern Cheyenne Indian Reservations, the ***Linking American Culture and Science under the Big Sky Project*** *(Highlight 19003, Award 0634587)* works to improve the science achievement of American Indian students in grades 3-8. Through creating and utilizing cultural contextualized teaching materials and methods, the project hosted a "Cultural Camp" as part of an institute which focuses on developing Master Teachers in science. The project, which had successful results as measured by at least three indicators, engaged over 50 teachers throughout the year in quarterly classes and a summer institute by taking courses collaboratively designed by both faculty and tribal consultants. These courses focused on topics such as Greenland glaciers, Mars exploration, paleaoclimatology, weather and climate and Crow astronomy and the relation of these topics to indigenous perspectives. This project obviously has a strong focus on broadening participation. It provides an approach that connects science and science education to the experiences and culture of an underrepresented minority, making instruction in the sciences more compelling and effective. The project also educates teachers in the culture of the underrepresented minority they are educating. This approach of connecting science education to a cultural setting, educating teachers about the culture of their students, and finding linkages between local scientific understandings and broader scientific knowledge is applicable across cultural groups and settings. It also provides a model for higher education--K-12 partnerships-- as well as an effective approach to teacher education.



Another highly integrative project, involving 5 research and education outcomes and evaluation criteria, is ***University of Hawaii-Manoa NSF Graduate Teaching Fellows in K-12 Education Bridge Research and Education through Partnerships*** *(Highlight 19317, Award 0538550).* Joanna Philippoff, a GK-12 Fellow at the University of Hawaii-Manoa, conducts research on determining the feasibility of collector urchin to act as a biological control agent in suppressing the growth and spread of alien and invasive macroalgea. Philppoff's research is connected to a GK-12 program that currently involves 6 graduate fellows working with 750 K-12 students and 19 teacher participants on four of the Hawaiian Islands monitoring between 15 and 20 inter-tidal sites each year. The project data, which are collected by K-12 students, is utilized by resource managers and researchers. The project also provides an educational forum that integrates traditional Hawaiian land management concepts with modern tools and technologies. Together, graduate fellows, K-12 students, and teachers work as scientists investigating streams, inter-tidal organisms, corals, sand, algae, and deep-water ecosystems. These data have contributed to doctoral dissertation research and a manuscript accepted for publication. This 6-year project is a model for integrating significant research and education, as well as field and lab research. It also is an outstanding example of engaging learners at all levels in an ongoing research project. It also highlights broadening participation and broader impacts in that it involves an underrepresented minority in a highly replicable project with significant educational and societal impacts.