Innovation through Institutional Integration ($I^3$)

2010 Joint Annual Meeting:
Sustaining Diverse Environments
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Division of Human Resource Development
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Creativity, connectivity, integration, and synergy are keys to innovation and to developing human and institutional capacity to full potential. In both research and education, it is the forging of new links between ideas or methodologies that were previously disparate that frequently paves the way for innovation.

When institutions optimize the benefits to be derived from the creative integration of intellectual perspectives or related domains of work, they create important opportunities for making progress on some of the most important scientific, technological, and educational challenges of our time.

_Innovation through Institutional Integration (I^3)_ is a cross-divisional activity in the Directorate of Education and Human Resources that challenges faculty, administrators and others in institutions to think strategically about the creative integration of NSF-funded awards towards a whole that exceeds the sum of its parts. On individual campuses across the nation, significant synergistic potential can be ignited when scholars and educators in related disciplines to work together. Similarly, NSF awardees can harness new synergies by working together with other NSF-funded projects on their own campus or in close geographic proximity. When the results of these synergies are both compatible with and beneficial for the institution(s) involved, successful innovation can be created.

The I^3 effort has the following interrelated goals:

- Increase synergy and collaboration across NSF-funded projects and within/between institutions, towards an educational environment where artificial boundaries are significantly reduced and the student experience is more fully integrated;

- Expand and deepen the impact of NSF-funded projects and enhance their sustainability;

- Provide additional avenues to broaden participation through workforce development, especially for those underrepresented in science, technology, engineering, and mathematics (STEM) research and education; attend to seamless transitions across critical education junctures; and/or provide more effectively for a globally engaged workforce;

- Promote innovative programming, policies, and practices to encourage the integration of STEM research and education; and

- Encourage STEM educational or related research in domains that hold promise for promoting intra- or inter-institutional integration and broader impacts.
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The Modeling Institute at Arizona State University (ASU) integrates a number of funded endeavors in order to generate an enduring STEM certification and professional development program for elementary school teachers to become middle school science and mathematics teachers. Drawing on NSF/EHR-sponsored initiatives in STEM teacher education awarded through MSP, TPC, ITEST, NSDL, IGERT, and on other awards, The Modeling Institute employs modeling as the integrative construct, connecting mathematics and scientific content through meaningful activity. The Modeling Institute leverages the successful aspects of many prior programs and prior research projects while opening a dialogue among scientists, mathematicians, and educators who have worked separately in the past to create a whole that is greater than the sum of its parts. The result of this $I^3$ effort is intended to be the production of 200 middle grades STEM educators, development of ten STEM sustainability themed master’s level courses, and the persistence of these STEM educators as professionals through the establishment of professional learning communities, a professional development network, and learning opportunities. The Modeling Institute focuses on the integrative theme of critical education junctures at the middle grades level. Additionally, graduates will be equipped with a toolbox of knowledge and skills to broaden participation in STEM studies by engaging students in dynamic mathematics and science learning. (Award: 0930109)

Coordinated EHR Awards

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Innovation through Institutional Integration: The Modeling Institute

This project is responsible for the creation of a 5-semester program, designed to help K-8 certified teachers become highly qualified to teach science and mathematics in the middle grades. The program has a sustainability science theme and is grounded in Modeling Instruction pedagogy. Modeling Instruction is a guided inquiry approach that centers learning on the construction, validation, and application of conceptual models—essentially helping students learn to “do science” as scientists do.

The Modeling Institute draws upon significant work on middle level STEM improvement and teacher preparation. It addresses the issue of professional advancement for in-service teachers by integrating the efforts of the following programs: Modeling Physics (numerous NSF grants); Project Pathways (MSP) Professional Learning Community Resources (TPC); Learning Through Engineering Design and Practice and Prime the Pipeline Project (two ITEST grants), Ask-a-Biologist (NSDL), SMALLab (CISE & IGERT) the Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER); and its MARS education program (NASA funding).

Developed in partnership with Mesa and Chandler school districts, two of the fastest growing districts in the State of Arizona, this project leverages the most successful aspects of each of the programs mentioned above to generate a sustainable STEM endorsement and a Master’s degree program for elementary school teachers to gain the knowledge and expertise needed to become middle school science and mathematics teachers in urban Phoenix and rural Maricopa county schools.

As a part of their learning experience, Modeling Institute program participants will engage in two supervised intensive teaching experiences of two weeks duration, (one in each of the two summers of their master’s program) in which they will practice newly acquired instructional approaches, teaching middle school students who attend our newly created ASU STEM Summer College for Kids camp that will take place from June 21st through July 23rd, 2010.

In addition, this partnership will provide the nucleus for a vibrant STEM education network—STEM-net—to support ongoing K-12 teacher professional development and collaborations among university researchers and secondary STEM teacher educators across campuses and colleges at ASU. While the Ask-A-Biologist web presence scales up to become Ask-A-Scientist we will likewise prepare for the launch of STEM-net this coming Fall.

Nine months into our first year of grant activity, our first cohort of K-8 teachers will begin the first two courses of their Middle School STEM Master of Natural Science (MNS) degree program on June 7, 2010. Thus far we have accomplished the following:

- Conducted focus groups of K-8 teachers to help us establish logistical and design parameters for the new master’s degree program.
- Coordinated with project partners to design the Master of Natural Science program courses.
- Obtained approval to establish a new Master’s program from the university.
- Attempted to raise additional teacher support funds from private foundations.
- Surveyed K-8 teachers to establish the nature and extent of the market for our new MNS degree program.
- Recruited from Phoenix metro area K-8 teachers to participate in the MNS program.
- Developed and taught a mathematics bridge course, designed to provide elementary teachers with algebraic concepts and skills necessary to be successful in the more rigorous MNS courses.
- Launched a new Ask-A-Biologist website with an expansion framework that can be scaled up to become Ask-A-Scientist.
- Created a Middle School STEM College for Kids program with 7 two-week summer camps that will serve as a field placement for teachers in the program while providing an engaging summer informal science experience for children.
Throughout the launch of this project, co-PIs representing a collection of NSF-funded projects at ASU have worked closely on the design of programs and curricula and helped broker new relationships with ASU offices, programs and colleges as ASU reorganizes to address critical state budget cuts.

The economy and Arizona state budget have had a profound impact on both ASU and on K-12 education in the past year. Between the writing and funding of this grant, over 40 schools, colleges and programs at ASU were disestablished in massive university reorganization. Seven weeks ago, a second reorganization was undertaken, closing additional ASU colleges, schools and programs. Meanwhile, in Phoenix area school districts, severe cuts and layoffs have left many K-8 teachers without jobs for the coming year. The Modeling Institute has been faced with some challenges as a result of these events.

As a part of our baseline data collection process, an online interest survey was administered in the Mesa, Gilbert and Phoenix school districts from March 22nd through April 19th. This survey was also extended to a national audience, garnering a total of 390 responses. Of the 171 Phoenix area participants who responded to the survey, 96 teachers (56%) expressed interest in pursuing additional coursework in science or mathematics. Teachers’ inclination to enroll in a master’s level degree program that targets mathematics and science content was related to their perceptions of being lifelong learners and a desire to become better teachers by increasing their content knowledge and teaching expertise. Key factors related to reluctance to apply for such a program were program cost and time required to obtain a master’s degree. This needs assessment indicates that there is a large group of in-service teachers interested in additional courses in mathematics and science content, and a large pool of these teachers are interested in the Model-it Master’s Degree program.

Between the beginning of April and mid-May, we received over 35 queries about the availability of space in the first MNS cohort. However, there are only 9 students presently registered for Cohort 1, which will begin classes on June 7, 2010. At one point we had 13 teachers committed, but four have withdrawn due to financial and employment concerns (we can provide teachers with only $800 per semester in tuition assistance, against a tuition expense that has grown to $3200 per semester). One program applicant who withdrew reported she had received a lay-off notice; others indicated they were simply unwilling to take on additional debt in light of current financial uncertainties. Going forward we plan to redouble our efforts to locate external funding to provide additional teacher support.

Another challenge we encountered 7 weeks ago was the closure of the Herberger Community School with whom we were partnering to offer our new STEM Middle School College-for Kids summer programs. The Herberger Community School hosted summer arts programs for youth for 6 years, and was delighted to add Middle School STEM courses to their roster of offerings. They had all the necessary infrastructure in place to advertise, accept registrations for and coordinate these day camps. On March 30, 2010, the Community School was closed and all their summer camp offerings cancelled. We were faced with the choice of 1) coordinating all outreach, registration and camp logistics ourselves, 2) cancelling the program this summer and reconstituting it again next year, or 3) finding another ASU entity to take over coordination. We chose the latter course, and, after 3 weeks of searching, found a new sponsor in the office of the Vice President of Educational Partnerships (VPEP). As a result of their marketing assistance, we have successfully filled 5 of the 7 courses originally planned. College for Kids will launch on time on June 21st with approximately 80 students in 5 different courses: I Love Bugs, Physical Computing, Transforming the Future, Adventures in Mathematics and Gamebot. Discussions are under way to form a long-term partnership with VPEP to offer these classes annually going forward.

During this first year, program evaluation has proceeded smoothly. Focus groups were held as planned and survey findings were consistent across districts. Moreover, Phoenix metropolitan area survey results were consistent with the larger national sample. Although we attempted to reach teachers in our partner district, Chandler, the district’s IRB was slow to act on our request and unfortunately we were unable to collect data from this K-8 teacher population. For the next attempt to conduct such a survey in the Chandler district, we will begin earlier to allow enough time to secure their permission.

Despite a challenging first year, the Modeling Institute is poised to begin its summer programs as planned.
Building an Integrated Identification, Engagement and Assessment Infrastructure for STEM Enrichment Programs at Hunter College

PI: Vita Rabinowitz, Provost

The I³ award at CUNY Hunter College will increased synergy and collaboration across multiple projects by creating a multifaceted model of institutional integration, transforming how STEM enrichment programs are made available to students at Hunter, facilitating faculty work in the area of student education within the STEM enrichment programs and collaboration across programs, and leveraging the intellectual capital of the grant-funded programs. By focusing on the three major areas of student recruitment and identification, student engagement, and the creation of an information infrastructure for student tracking and reporting, the project is viewed as having tremendous potential in the K-14 systems that serve as feeders to Hunter College. The project is attempting to impact students at all points in their education but most importantly in the preadmission stage. Specifically, the project seeks to identify students for recruitment into the STEM programs at a much earlier time and broaden participation; expand the paths for information about and application to the programs at critical educational junctures; reinvent the mentoring of students in the programs and their research placement to better integrate research and education; and assess their effectiveness and track their students to create an information loop which will feed back into each stage of the process. This project could serve as a model for similar colleges and universities.

Coordinated EHR Awards: S-STEM, Noyce, RDE, MSP, LSAMP
Hunter College’s Innovation through Institutional Integration Grant (Award # 0963626)

Building an Integrated Identification, Engagement and Assessment Infrastructure for STEM Enrichment Programs at Hunter College

PI: Vita C. Rabinowitz, Provost and Vice President for Academic Affairs
Co-PIs: Annemarie Nicols-Grinenko, Office of the Provost
        Nancy Greenbaum, Chemistry
        Deborah Gardner, Office of the Provost
        Joan Lambe, Institutional Research

Start Date: June 1, 2010

Some of Hunter College’s most important and transformational funding is in the form of large institutional grants that provide unique educational opportunities for its students and also prepare them for advanced degree programs. Most of these grants target underrepresented women and minorities and students with disabilities in STEM disciplines. There are currently 16 STEM enrichment programs at Hunter, including five funded by the NSF.

Hunter’s I-cubed project aims to transform the way STEM enrichment programs are made available to students at Hunter and facilitate the work of faculty in educating students in these programs and sharing information and opportunities across programs. The project will
a) identify students for recruitment into STEM enrichment programs at a much earlier time;
b) expand the paths for information about and application to these programs at critical educational junctures;
c) broaden participation in Hunter’s STEM enrichment programs;
d) reinvent the mentoring of students in the programs and their research placements to better integrate research and education; and
e) assess program effectiveness and track student progress to inform and improve recruitment and retention into Hunter’s science programs and majors and enhance students’ opportunities once they graduate.

The I-cubed project will achieve these goals by creating a multifaceted model of institutional integration that is innovative and brand new for Hunter. With a new administrative function in the Office of the Provost, complementing a Science Advisory Board (SAB) and a Diversity Advisory Board (DAB), the plan will bring together faculty and professional staff from Student Affairs, Institutional Research, Assessment, and Institutional Technology, use new technology, and create a sustainable infrastructure for the science programs which can accommodate growth and continuing innovation.

Initiative #1 (Recruitment and Identification) includes a significant and innovative improvement of Hunter’s recruitment and identification activities for students interested in the STEM disciplines. The goals are: a) identifying more potential STEM majors (and at an earlier point in their academic careers), b) improving advisement for students in selecting STEM courses and majors, and c) ensuring that students are well informed about all STEM opportunities at Hunter. Identification of potential STEM students takes place at four important junctures: when they apply to the college, when they are admitted to the college, when they accept admission to the college, and after they have enrolled in STEM courses. The fulcrum for harvesting this information is a promising new tool, Hunter’s web-based Constituent Relationship Management (CRM) system, which manages
information, synchronizes with other existing student data systems, and can be customized in many ways for a dynamic communication system between students and the college. Working with the Registrar, the Office of Student Affairs, the SAB, the DAB and the Directors of Hunter’s STEM enrichment programs, the I-cubed project will a) program the CRM to identify applicants and current Hunter students with an interest in and/or aptitude for STEM, b) develop recruitment messages to be sent to students via the CRM and other venues, c) distribute appropriate STEM-related materials and announcements about events based on applicant/student interest, d) request more detailed information about STEM interests from applicants/students to allow better course and program planning, and e) track student progress and participation in STEM activities at and beyond their time at Hunter.

**Initiative #2 (Student Engagement)** is a cross-program, collaborative effort to improve student engagement and student mentoring, better integrate research and education in Hunter’s STEM enrichment programs, and socialize students into Hunter’s scientific community, with the ultimate goal of retaining and advancing our students in science. Almost all of Hunter’s STEM enrichment programs include a mentoring component that pairs student participants with a faculty mentor. The I-cubed project will expand the mentoring opportunities available to our students so that they may be mentored by a *circle of advisors* that includes other faculty, their peers and graduate students in the sciences. I-cubed will work with the SAB, DAB, and Directors of the individual STEM enrichment programs to develop an “experts” database of faculty and students who will serve as advisors on skills and experiences that will benefit the scientific and research careers of students in Hunter’s STEM enrichment programs (e.g., presenting at a scientific conference, applying to graduate school, writing a fellowship proposal). While many of Hunter’s STEM enrichment programs include at least some professional and skills development activities, the I-cubed project will offer a full slate of activities – many more than any one program would be able to offer on its own. I-cubed will help coordinate activities offered by the individual STEM enrichment programs so that students from other programs may participate and offer additional workshops and activities to ensure that a full range of professional and skills development topics are available each year.

**Initiative #3 (Creation of an Information Infrastructure for Tracking, Reporting and Assessment)** entails the creation of an integrated mechanism to track, report, and assess our existing STEM enrichment programs at Hunter. Currently, our programs maintain student data in separate and compartmentalized systems of data management that were launched at different times and according to different eligibility criteria. The resulting variations in methods of data collection and management limits Hunter’s institutional capabilities to share and exchange student data across programs. The I-cubed project will create an integrated platform by executing a set of new strategies mapped on the capabilities of our newly installed CRM (Constituent Relationship Management) system. The impetus behind establishing this strategy-technology synergy is threefold: Maximizing the efficiency and effectiveness of Hunter’s institutional tracking mechanism; creating a common reporting infrastructure that can view student data longitudinally; and developing actionable information for an evidence-based system of improvement for all of Hunter’s STEM enrichment programs.

**Sustainability:** By institutionalizing the use of Hunter’s new CRM system to enhance its STEM enrichment programs, Hunter hopes to create a model for other academic units to follow. Hunter will also institutionalize the I-Cubed project director position as a full-time member of the Office of the Provost.
City Tech I-Cubed Incubator: Interdisciplinary Partnership for Laboratory Integration

PI: Bonne August, Provost and Vice President for Academic Affairs

The City Tech I-Cubed Incubator: Interdisciplinary Partnership for Laboratory Integration is designed to achieve meaningful integration of a central element in STEM education, one that cuts across all STEM disciplines—basic and applied—the laboratory. The program will create a cross-project management structure for grant funded STEM lab research programs. Building upon existing CREST, GSE, ADVANCE, STEP, and S-STEM awards, the Incubator will create a common framework for outreach, student engagement, industry involvement, diversity goals, and significant learning outcomes. The Incubator furthers the I³ goals of broadening participation by enabling underrepresented students to engage in applied STEM learning, of integrating research and education with a focus on inquiry based research as a means of learning, and of developing a global workforce by expanding industry representation within the college to enhance their technological workforce needs through collaborative education projects. (Award: 0930242)

**Coordinated EHR Awards**

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**The City Tech I³ Incubator: Interdisciplinary Partnerships for Laboratory Integration**  
NSF Award #0930242, 1st Year

**Purpose.** The City Tech I³ incubator is an innovative project that addresses the NSF I³ goals: Increasing synergy across NSF-funded projects, deepening their impact and enhancing their sustainability, broadening participation and workforce development, and integration of research and education. City Tech aims at attaining these goals by providing an innovative framework for integration across existing NSF-funded projects at the college, and by transforming the laboratory experience for STEM students to reflect the collaborative, interdisciplinary approaches of current scientific and industrial labs.

As an incubator, City Tech’s I³ program encourages experimentation in laboratory practice and research, creates a flow of ideas and innovative projects, encourages exchange between faculty members, and identifies and disseminates best practices of external partnerships. It provides the infrastructure for initiation and maintenance of collaborations and partnerships.

**Integration of NSF Projects at City Tech and Related Challenges.** In that vein the incubator introduced a series of regularly occurring events where PIs and Co-PIs of currently funded NSF projects at City Tech get together for discussions. In one of these events in May of 2010 representatives of six NSF-funded projects, STEP-MMNet (PI: Dean Pamela Brown), ADVANCE-Catalyst (PI: Provost Bonne August), REU (PI: Prof. Reginal Blake), C-Path-1 (PI: Prof. Raffael Guidone), S-STEM (PI: Prof. Li) and S-STEM (PI: Prof. Natov), as well as other interested faculty members met to learn about each others’ programs and to discuss approaches towards better integration as well as mechanisms to deepen their impact. For this meeting we used a tool that was developed together with the external evaluator, the project coordination matrix. The matrix represents each project through a list of descriptors that include diversity, integration of research and education, lab component and industry involvement. Together with the external evaluator these data will be analyzed to identify best common practices, general overlap as well as unique features. This information will, in turn, be used to lay out a plan for future activities, which will then be addressed in the follow-up meetings.

The individual NSF-funded projects at City Tech have their own goals and faculty involved create their own committees, agendas and schedules. Getting all or a majority of them together and having them communicate their ideas and activities is a natural challenge in project level evaluation for the incubator, but our regular events for PIs and Co-PIs of existing NSF projects address this challenge directly. The objective is to establish the coordination of NSF initiatives at the college as a long-term mechanism. The most effective features of successful NSF-supported projects will not only be identified but institutionalized through the incubator.

The City Tech I³ project aims at integrating across many different organizational structures and levels: Integration of laboratory content, technology and pedagogy between different schools and departments, between upper and lower divisions of study, integration across existing NSF-funded projects and integration of external industry partnerships. The mere complexity of this project poses a challenge in terms of coordinating all of these aspects. We are continuing to work on an infrastructure that will enable us to include all these components in an optimal way.

This is supported by City Tech’s commitment to sustain the incubator as a permanent mechanism for continuous STEM improvement. A project coordinator for I³ at City Tech was hired. Dr. Michaela Oswald will be coordinating the logistics of the incubator activities and ensure asset recognition within the college.
Laboratory Focus. The City Tech Incubator focuses on the lab experience of the student, both in the classroom and in industry internships. In order to respond to the constantly changing needs of the work market the incubator aims at creating innovations in lab content, lab pedagogy and lab technology. This need is addressed by introducing interdisciplinary case studies. A case study in this context is the collaboration of one professor who represents the School of Arts and Sciences, another professor who represents the School of Technology and Design, and an external partner from industry. Together, they work on improving curriculum and teaching methods of one of the science courses by adjusting it to the needs of the study program and industry. We are planning to conduct one case study per year, and the first one is already in progress. It is a Bioinformatics case study that bridges between the Biology Department in the School of Liberal Arts and Sciences and the Computer Systems Department in School of Technology and Design. This prototype will go into action in the fall of 2010; its timely theme of Computational Thinking reflects a strong need in today’s industry. A case study team works for a year, produces modified instructional units, presents it to wider audience, and disseminates the results.

In order to measure effects of innovations of any kind we are developing a multi-dimensional model of lab experience that identifies the relevant parameters for description (e.g. curricular mode, student motivation, use of technology, etc.). Together with our external evaluator we are creating surveys for course instructors and students of all ongoing labs as well as for students involved in faculty conducted research. These will be distributed on a regular basis and their results will be used as baseline against which innovations shall be benchmarked. We hope that our way of quantifying lab experience will become a generic tool for assessing changes in curricula at City Tech.

Lastly, the City Tech I³ incubator approaches internships as a laboratory experience for the students. We are planning to collect information about current internship frameworks at various departments at City Tech and to assess the internship experiences of the students. The goal is to identify best practices of internships, understand how they help students to prepare them for future employment and to disseminate this information to City Tech faculty and industry partners.

The findings of the City Tech Incubator on improvement of undergraduate STEM education and enhancing synergy across NSF initiatives will be collected and disseminated to faculty, industry partners, and the wider community. As a platform, a website for City Tech I³ was developed that interlinks with other City Tech NSF projects, I³ initiatives at other institutions, and has details of I³ related activities at City Tech.
The Tech to Teaching project at the Georgia Institute of Technology aims to coordinate the systems, procedures, personnel, and resources necessary to ensure that pathways to teaching careers are clear and well-lit for both students and their advisors. By implementing a more informed and coherent advising system, developing introductory education courses, providing mentors, and easing the transition into teaching through professional learning communities, this I³ project expects to smooth critical education junctures for Georgia Tech students who seek to teach STEM at either the K-12 or the collegiate level. Georgia Tech is uniquely positioned to develop such a pipeline because it educates high-quality STEM students who can choose any pathway to success that interests them; yet traditionally, little has been done to facilitate a coherent route to a teaching career for these students. The institution hosts a number of externally funded projects that focus on preparing STEM students for professional success, including GK-12, AGEP, IGERT, RET, NOYCE, ADVANCE, and REU awards. Tech to Teaching expects to align and adapt the initiatives developed through these projects to create the necessary infrastructure on the Georgia Tech campus that will encourage and enable students to effectively and successfully pursue careers in college or K-12 teaching. (Award: 0833434)
An innovative and integrative activity (or activities), with supporting evidence of efficacy

1. Pre-Teaching Summer Undergraduate Research Experience program (PT-SURE):

Students who are interested in a career in teaching secondary science or math apply to participate in an undergraduate research program over the summer (preferably after junior year). They are placed in a lab that also has a teacher working on a RET (Research Experience for Teachers) project, and if possible, that has high school students working on a summer research project too.

This integrates our I3 (Tech to Teaching), various RET sites and project add-ons across campus, and support from the Siemens for high school summer research projects. Funding for the student stipends comes from our I3, funding for the teachers comes from the RET projects, funding for the high school students comes from Siemens, and each sponsoring lab gets access to funding from the Office of the Provost for supplies and other expenses. Last year (the first year of the program), we had I3 funding for 6 students. We had so many good applicants that the Office of Undergraduate Studies at GT sponsored an additional 3 students. This year we have grant funding for 9 students and they have just been placed for their summer appointments.

We did focus groups and surveys with the participants of the program last summer. Here are some highlights of those results:

- GT students seemed to have benefited both from interactions with their teacher partners and with high school students. GT students mentioned the interesting and informative conversations they had with their teacher partners, and talked about how these conversations provided insight on what it's like to be a teacher. Several GT students indicated that working with the high school students "made" their experience.

- GT students felt they had acquired skills related to teaching as a result of their participation in this program. These skills included patience, knowledge of strategies for helping high school students learn, and knowledge of logistical aspects of teaching such as becoming certified and making lesson plans.

- All GT students responding to the item agreed that their participation in this program would make them a better teacher.

- Seven out of eight GT students responding to the item agreed that their participation in this program would improve their chances of success as they moved along the pathway towards a career in teaching math or science.

2. Teaching and Learning Practicum for advanced doctoral students

Doctoral students in STEM disciplines who have certain pre-requisites have the opportunity to do a practicum in teaching and learning in higher education. In our newly defined pathway model, students first have to TA for at least two semesters, and take our first course in Teaching and Learning in Higher Ed. Then they can apply to do a
practicum where they choose a mentor faculty member and work out an agreement to shadow this professor and take on certain responsibilities for their course. In addition, they enroll in a learning community which helps to focus their experience, lead to a more reflective practice, and includes teaching observations from both their peers and our staff.

This integrates several other practicum models on campus including one from our AGEP project and several IGERTs and a GK-12 project. This past Spring semester was the first offering of the practicum officially and we had 6 students participate. One student chose to do her practicum at a local private women’s Liberal Arts College instead of our campus since that is the type of institution where she would one day like to work. The experience was so positive that the Dean of the College of Sciences there asked for a formal agreement to send more of our students to do their practicum there – even though we provide no funding to the mentor for taking this on.

We did individual interviews with the students who participated in this program but since that just occurred within the last two weeks, we do not yet have a synopsis of those results.

A challenge that has posed a potential threat to project work, and the project’s response to that challenge

The greatest challenge is the same as it was when we were writing the proposal – individual PIs have their own agendas and their own deliverables. Making time and energy available to work towards a greater/different goal is difficult. I am not sure that we have found an adequate response to this challenge yet. For the most part, what we do is offer services and resources that relieve these PIs’ burdens a bit and then request that they network with us to give us other ideas of how we can better integrate across campus. This is an ongoing challenge.

A challenge(s) in project-level evaluation

We ran into an interesting challenge with our evaluation plan. We want to be able to track students across campus who participate in any aspect of our program. Since the very nature of our program is that some of these events are not sponsored directly by us (that is the integrative part!), we can’t really impose a central consent form. Getting our institutional research and registrar folks to give us access to the data that we need to simply track participation has been challenging.

Plans for sustaining the work of the I3 project

The courses and workshops (including the practicum and learning communities) that we have implemented will continue after the project ends. More importantly, it is our hope that the cultural shifts that we are working to create will be maintained and even continue to change to make the pathways to teaching careers more respected and effective.
Strengthening the Professoriate at Iowa State University (SPISU): A Campus Network to Enable Strong Science and Diverse Communities

PI: Carlson, Susan L., Associate Provost for Faculty Advancement and Diversity

*Strengthening the Professoriate at Iowa State University* (SPISU) will invigorate and *diversify* the professoriate of ISU by creating a community of scholars who focus on integrating broader impacts efforts into their research enterprise. The $I^3$ initiative will work to amend the lack of diversity in the STEM workforce, particularly among the faculty by encouraging women and minorities to persist in STEM with flexibility in faculty careers and transforming department level climates. It sets up a situation in which the institution puts a tangible value on broader impact efforts in the promotion and tenure process and increases efforts to diversify the faculty. The community will include post-doctoral scholars and advanced graduate students who will be mentored by faculty as they increase the awareness and skills needed to develop plans for broader impacts to complement their research skills. Placed squarely within the education and research missions of the university, SPISU could create an institutional model that is potentially transformative and could be replicable beyond ISU.

Coordinated EHR Awards: ADVANCE, AGEP, STEP, REU
ISU I³ Program Progress Summary
for the NSF JAM10 I³ “birds-of-a-feather” session

The ISU I³ program is titled “Strengthening the Professoriate at Iowa State University (SPISU): A Campus Network to Enable Strong Science and Diverse Communities.” The program will begin on July 1st, 2010. To date, the efforts have focused on the basic preparation for the personnel and physical space to be available once the grant begins. The program has been received positively from all ISU units, so the work is proceeding with great interest and assistance from the ISU community. Since the work has not progressed to the point of providing the information on assessment outcomes and program challenges that were requested for JAM10, the following provides a brief summary of the ISU plans.

The ISU I³ program GOALS:

1. Build on current NSF programs to increase efficiency and effectiveness of ISU programs to broaden participation in STEM.

2. Create clearing house of programs, resources, people, and information for faculty to develop well researched broader impacts plans as part of their research enterprise.

3. Develop protocols for assessment and evaluation of a faculty members broader impact initiatives for inclusion in the promotion and tenure process.

SPISU Program Activities:

1. Resource Referral and Assistance: Assist faculty to develop their broader impact plans by connecting them to ISU programs and published literature. SPISU program will offer assistance through a website, office staff, and STEM college equity advisors.

2. Study Communities: Study communities will be formed for structured study of topics related to broader impacts. The goals of these study groups are for the participants to (1) form a community of collaborators, (2) carefully study the literature on typical broader impact activities, and (3) develop broader impact plans that are based on literature and vetted by the members of the study group.

3. Coordinate Program Development: The SPISU program will facilitate collaborations across campus, building on prior partnerships, to spawn new groups that pursue funding opportunities.

4. Evaluation: SPISU activities will be evaluated for continuous improvement of SPISU activities and operation. In addition, the evaluation of faculty broader impacts work will be used in developing promotion and tenure protocol and evaluation processes that reward broader impacts initiatives.
5. **Dissemination:** The SPISU program will share best practices and research findings nationally. The intent is to provide other universities and colleges with 1) models for increasing the training and participation of faculty, post-doctoral scholars, and advanced graduate students in broader impacts work and 2) models for improving faculty evaluation, promotion, and position responsibility statements.

**SPISU Signature Programs:**

1. **Inclusive Protocols for Promotion and Tenure:** SPISU intends to develop a clear protocol for faculty evaluation and review, one that values faculty involvement in programs and initiatives that contribute to broader impacts.

2. **College Equity Advisors.** An innovation central to the ISU ADVANCE program, College Equity Advisors will guide the development of a culture that values broader impacts among faculty, post doctoral scholars, and students in each of the five STEM colleges. Three STEM colleges have Equity Advisors as part of ISU ADVANCE and through the I³ program the two other STEM colleges have agreed to develop College Equity Advisors.

3. **Training the next Generation of Faculty.** Working with new faculty, advanced graduate students, and post-doctoral scholars, SPISU has the potential to shape a new model for faculty that makes broader impacts an integral part of their research enterprise.

**Activities Thus Far:**

In preparation for the grant beginning, the efforts have focused on basic preparations for the work, including:

1) Developing the detailed position description for the director

2) Working with the Office of Executive Vice President and Provost and the ISU ADVANCE program to setup the accounting support, office space, and basic equipment infrastructure.

3) Initiating discussions with College Equity Advisors who are one of the cornerstones of the proposed effort.
Faculty Integration, Research, and Engagement in Urban Polynesia (FIRE UP)

PI: Leon Richards, Chancellor

*Faculty Integration, Research, and Engagement in Urban Polynesia (FIRE UP)* focuses on building and sustaining a formal STEM program of study and on increasing the number of engaged STEM faculty at Kapi’olani Community College (KCC). Building on the success of prior TCUP and STEP awards in attracting STEM students to KCC, this I³ activity will create a “formal STEM enterprise” with the inclusion of STEM objectives into the five outcomes of the institution’s strategic plan and with a newly certified Associate of Science in Natural Sciences degree. *FIRE UP* expects to broaden participation in STEM fields by developing well-prepared faculty who can offer challenging classes, mentor students, and expand the reach of KCC’s STEM program to attract Native Hawaiians to STEM fields. KCC will systematically provide release time to its STEM faculty enabling them to fulfill Individual Development Plans through research, summer institutes, online/hybrid STEM courses and by mentoring undergraduate research interns. This invigorated faculty workforce will help meet the demands – education, research, mentoring, and other student support – of the growing numbers of students pursuing STEM. (Award: 0833482)

**Coordinated EHR Awards**

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<tr>
<td>TCUP</td>
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<td>STEP</td>
<td>STEM Talent Expansion Program</td>
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Principal Investigator, Leon Richards, and Co-PIs, John Rand, Robert Franco, Judith Kirkpatrick recognize that KCC’s continued success is contingent upon building a formal and institutionalized “STEM enterprise” and developing more engaged STEM faculty who offer compelling courses as well as mentor students in undergraduate research.

Overview
The cross-cutting nature of FIRE UP has introduced tools that measure STEM institutionalization progress, summer faculty development workshops aimed at increasing student retention and success rates in the STEM classroom, and other program changes that increase collaboration amongst STEM faculty. Practices embedded in STEM faculty development opportunities allow faculty to improve their teaching and subsequent success rates in their classes. Multiple measures including formative and summative assessment, focused group discussions, and STEM student tracking indicate a significant growth. STEM faculty members are actively engaged and mentoring students. They provide undergraduate research experiences for STEM students and use intrusive advising to encourage students to choose STEM as a major. The challenge lies in broadening the awareness of the program’s opportunities to all faculty and students in other disciplines and to fully integrate these efforts broadly throughout the institution.

Goal 1. Institutionalizing, improving and sustaining a formal STEM enterprise

AIM (Assessment of Institutionalization Map) Survey Challenge
We developed a tool to measure institutional integration of the STEM program. In February 2009, Kirkpatrick and Rand implemented and analyzed a comprehensive staff and faculty online assessment of STEM institutionalization survey (N=196). Results baseline STEM institutionalization and provide data to guide and develop strategies for implementation of a three-year Math & Science Department tactical plan to create the organizational, administrative and programmatic excellence and infrastructure. The first AIM report demonstrates details of the statistical results and analysis applied to Kapi‘olani’s first administration of the AIM Survey as a basis to inform Math/Science tactical planning; however, as a comparative tool, it will grow more interesting after the AIM survey is administered again in 2011 and 2013, to gauge whether the STEM Program has been successful in its institutionalization efforts. The challenges of administering this survey were solved by asking our Chancellor do two things: 1. At the general faculty meeting in January 2009, he discussed the STEM program and this survey as something he wanted faculty to take. 2. Also, we had the Chancellor use his email employee list deliver the request to faculty directly from the Chancellor.

EAC (External Advisory Committee) Integrated Meeting Challenge
The FIRE-UP leadership team combined three grants’ advisory committees into one umbrella EAC that advises the College on the success and needs for improvement for its NSF grant implementation. We combined TCUP, STEP-UP and FIRE-UP EACs under one group of five members and challenged the EAC to come up with a shared definition of the role and responsibility of an advisory committee. We presented an overview explanation of grant activities by grant coordinators, and developed and
implemented a two-hour exit focus group interview of the EAC. The challenge we have encountered in the past was that we could not get a concise report and response from our external advisory group. We solved this by developing a focus group strategy with them. The report from the focus group now provides both praise and suggestions for improvement.

Goal 2. Increasing the number of STEM faculty engaged in producing STEM degree completers from six to 26, improving gatekeeper first and second year course success rates.

The FIRE-UP Summer Institutes (May 18-22, 2009 + May 17-21, 2010)
We have run two summer faculty development institutes that are aimed at teaching faculty to using research-based practices that increase student retention and success rates in the STEM classroom. The institute provides five full days where faculty members collaborate, communicate, and plan strategies for their teaching and other STEM Program work in interdisciplinary and transdisciplinary initiatives. The leaders of the institute challenge participants to adapt their teaching strategies and practices so that the diverse students we have in our classes are taught in styles where they can best succeed. Daily assessments provoke the participants to experience the power of classroom feedback, assessment, and communication. Daily assessments and reflective analyses are kept in an online project management system. Results are available in the FIRE-UP ePortfolio. An important component of the FIRE-UP institute is that we introduce participants to the power of undergraduate research at a community college, as we are developing a model that we believe works for our faculty and our students.

The Sencer (Science Education for New Civic Engagements and Responsibilities) Summer Institute (SSI)
In addition to the FIRE-UP Summer Institute, we send teams of new FIRE-UP institute faculty to participate in the summer SENCER Institute, partially funded by FIRE-UP.
The SSI is a team-based learning opportunity for academic leaders. The SSI stimulates teaching with civic engagement as a focus, through the design and development of courses and programs that teach "to" basic science "through" complex, capacious, and unsolved public issues. Reflective analyses by participants in SENCER are available for reading at the FIRE-UP ePortfolio site.

A challenge to this model of professional development is to provide stimulating, new and useful support for the group and for individuals. The power that comes from the group should keep the program sustained for years to come as long as these fired-up faculty stay at the school. With fewer incentives, the question becomes will faculty keep innovating or might they revert to a more passive participation within the program.

Independent Project-Level Evaluation: The contract with our evaluator took several months to be finalized. We received a six-month report from our independent evaluator, in December 2009, summarizing the project, and will receive a one-year report in August 2010. The evaluator’s representative spent an evening with the EAC and 1.5 days at the summer institute in May 2010. They also interviewed our top two administrators about the grant and were pleased to find knowledgable, enthusiastic administrators and conducted three phone interviews.
Louisiana State University

Integration of Education and Mentoring Programs at Louisiana State University

PI: Astrid E. Merget, Executive Vice Chancellor and Provost

Integration of Education and Mentoring Programs at Louisiana State University focuses on breaking disciplinary barriers and enhancing the synergy of more than 50 ongoing projects, including GK-12, LSAMP, and AGEP awards and primarily those projects led by the newly established Office of Strategic Initiatives and the Gordon A. Cain Center for STEM Literacy. The project aims to nurture students in an interdisciplinary environment to become “inspirational teachers, exemplary mentors, and effective leaders,” to raise LSU’s academic standing, to broaden participation in STEM, and to support and prepare students to readily relate to professional and public arenas. In order to achieve these goals, LSU will consolidate existing summer workshops for students, teachers, and faculty to increase collaboration and minimize redundancies. The project will also coordinate the integration of undergraduate students into K-12 public school classrooms as tutors, both in their successful math tutoring model and as mentors to science fair participants. LSU will leverage existing curriculum and research infrastructure to better integrate research elements into a materials science program. The I³’s management team will include a student-governing council, with members drawn from across all involved projects, in order to train student leaders and promote cross-project exchange. (Award: 0833461)

Coordinated EHR Awards

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<td>GK-12</td>
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<td>AGEP</td>
<td>Alliances for Graduate Education and the Professoriate</td>
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The I3 program at LSU is an institutional effort designed to integrate a large number of on-going science, technology, education, and math (STEM) education and outreach programs at Louisiana State University (LSU), especially those led by the LSU Office of Strategic Initiatives (OSI) and the Gordon A. Cain Center for STEM Literacy (CC). This project consists of five (5) tasks:

1. Consolidation of summer workshops and camps for students, teachers and faculty members
2. Leadership training in academics through a student-governing organization
3. High school math tutoring program by college students
4. Mentoring high school students’ Louisiana Science and Engineering Fair projects by college students
5. Integration of research into education in materials engineering and science.

Since inception, the LSU I3 project has initiated and participated in multifaceted institutional collaborations and partnerships. Largely these activities have fallen under the purview of one or more of the project tasks, outlined above.

**Task 1:** During the inaugural year of the program, the I3 program fostered collaborations among five programs within the OSI and CC. This included integration of seminars and field trips as well as hosting two education and networking events focused on integrating the programs and developing a sense of community. The programs that were impacted and the number of participants in each are as follows: OSI Summer Bridge (50 participants), OSI Summer Research Experiences for Undergraduates (OSI REU, 16 participants), Howard Hughes Medical Institute (HHMI) Professors High School Science and Math Summer Program (28 participants), Vertical Integration of Research and Education (VIGRE@LSU REU, 34 participants) and LSU Math Circle (34 participants). The programs scheduled to participate during the summer of 2010 are as follows: OSI Summer Bridge, OSI REU, HHMI Professors High School Science and Math Summer Program, VIGRE@LSU, LSU Math Circle, LAMP REU, PACER Program for Minority Institutions, CC Geaux Teach Program, Physics & Astronomy REU, Center for Computation & Technology REU, LSU/HHMI, LBRN, Engineering/CC RET, and Biological Sciences REU.

**Task 2:** Most recently, on Wednesday, April 28th, 2010, the I3 student governing council hosted a “CSI Crawfish Boil.” The event began with a presentation by three Forensic Anthropology graduate students from the LSU FACES (Forensic Anthropology and Computer Enhancement Services) Laboratory. After the presentation, the students were treated to a crawfish boil, a Louisiana tradition that celebrates food, friends and fun. Approximately 75 students, faculty, and staff from ten different programs were in attendance. An evaluation tool was posted on the I3 website after the event and the link was sent to all students who attended. When presented with the statement “Overall, I enjoyed participating in the CSI Crawfish Boil,” 90% of students who responded chose ‘5 – Very True’ on a scale of 1 to 5.

**Task 3:** The I3 program partnered with the CC and Advance Baton Rouge (a charter school program serving high-needs schools) to facilitate a math mentoring program called ALEKS Math Lab. The program takes place for two hours on six different Saturdays each spring and fall semester. LSU I3 students are present to serve as mentors to middle school children who need help building their math skills (24 students volunteered fall 2009 and 23 students during spring 2010). The middle school students use a web-based math skills program called ALEKS. The ALEKS Math Lab began in the fall of 2009 at Dalton Elementary, an ABR charter school in north Baton Rouge. Due to
the success of the Math Lab that first semester, they expanded the program to a second north Baton Rouge charter school, Lanier Elementary, in the spring of 2010. A third Math Lab was established at Kenilworth Science & Technology Charter School in south Baton Rouge. Six (6) different LSU students associated with the I3 program provided math mentoring for struggling students for six (6) weeks leading up to standardized testing. The LSU students were divided into shifts and an I3 mentor was present every school day from March 3rd through April 9th.

**Task 4:** This portion of the I3 program has been in the design stages and is getting ready to launch a summer version during the summer 2010 semester. Approximately 20 high school students, all members of the HHMI High School Science and Math Summer Program, will be paired with LSU graduate and undergraduate student mentors. These mentors will work with the high school students for 6 weeks to develop a science fair project that will be displayed at the annual Summer Undergraduate Research Forum (SURF). The summer program will then be modified for successful implementation during the upcoming fall semester.

**Task 5:** During the summer of 2009, the OSI Summer Bridge participants attended a lab tour at Southern University. Six graduate students from Dr. Guoqiang Li’s group were involved in this tour. The graduate students discussed and demonstrated the application and capacity of the equipment and ran some tests as a way of demonstration. The equipment demonstrated covered the full-range of fabrication, characterization, testing, and modeling of composite materials.

*A challenge that has posed a potential threat to project work, and the project’s response to that challenge*

A key challenge that the PIs and project manager have faced in this project has centered on the formation and growth of a functional and successful student governing council, as described in Task 2 of the LSU I3 grant. In this project, tasks 2-4 involve significant student leadership and participation, and we have found that a strong student governing board provides a solid foundation for advancing this project’s aims and goals. To ensure student participation, we have developed several initiatives which have included (1) an incentive program for voluntary leadership on the student council, (2) expanded leadership training within OSI mentoring courses for undergraduate program participants, (3) targeted recruitment approaches, and (4) close collaborations with PIs and OSI/CC program managers. The net outcome has been an increase in the numbers of sustained student leadership and participation in programmatic activities in all tasks.

**A challenges(s) in project-level evaluation**

The challenges faced with project evaluation have involved the development of assessment tools to accurately measure the impact of the various tasks. Herein, we have developed and are refining assessments aimed at all stakeholders and participants. Our evaluation models currently assess programmatic value, sustained participation, and the development of new partnerships and institutional initiatives for improving STEM education at the secondary, undergraduate, and graduate levels. Dr. Keena Arbuthnot, an assistant professor in the Department of Educational Theory, Policy and Practice, has been working with I3 throughout the spring 2010 semester to develop a comprehensive set of evaluation tools. These tools will be delivered electronically, through the I3 website, and in person at events and activities.

**Plans for sustaining the work of the I3 project**

The PIs have several plans for sustaining this project and these are closely aligned with each of the programmatic tasks. For Tasks 1-4, the initiatives developed through this I3 project will be sustained via integration into the OSI and CC infrastructures.

In order to sustain task 5, the I3 activities will be integrated into the newly funded NSF/CREST project at Southern University. In the NSF/CREST project, the subproject 2 (with Dr. Guoqiang Li as subproject 2 PI) focuses on smart, self-healing composite materials and structures, a topic intimately related to the I3 task 5.
The Center for Academic and Future Faculty Excellence (CAFFE) will connect, integrate, and increase the capacity of projects that target stages of the collegiate “pipeline” resulting in the production of STEM professionals. The project will integrate across NSF-funded AGEP, ADVANCE, REU, and LSAMP awards to develop a mentoring and professional development pathway for early career and future STEM faculty. Many groups and programs are presently making individual contributions to the development of new professionals, and these separate efforts will be interconnected and enriched by the I³ endeavor. CAFFE will coordinate the offerings of several programs to optimize the development of attitudes, values, and behaviors essential for smooth transitions across critical education junctures and the development of a workforce successful at meeting the 21st century challenges of the professoriate. This I³ aims to deviate from the linear view of the “pipeline” analogy and to focus on individual, rather than cohort, needs that may become evident at different times throughout an academic career. Drawing on existing programs, the unique and individualized model of CAFFE expects to ease the transition from undergraduate to graduate education and encourage retention and preparation for the professoriate, especially in underrepresented groups. (Award: 0930182)

Coordinated EHR Awards

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<tr>
<td>AGEP</td>
<td>Alliances for Graduate Education</td>
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<tr>
<td>ADVANCE</td>
<td>Increasing the Participation and Advancement of Women in Academic Science and Engineering</td>
</tr>
<tr>
<td>REU</td>
<td>Research Experience for Undergraduates</td>
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<td>LSAMP</td>
<td>Louis Stokes Alliances for Minority Participation</td>
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I-cubed at Michigan State University:  
Center for Academic and Future Faculty Excellence (CAFFE)  
May 11, 2010

CAFFE enables MSU to focus and integrate existing NSF projects and other on-campus activities/offices and to develop new initiatives to better prepare a diverse group of graduate students, postdocs and early career faculty to be successful faculty members http://grad.msu.edu/caffe/. CAFFE is designed to enhance the professional development of STEM and SBES participants in parallel with their development as research scholars.

**CAFFE goals include:**
A “menu” of programs, workshops, and activities organized by developmental stage that is a deliberate integration of the offerings currently provided by the Graduate School, Faculty and Organizational Development, the Teaching Assistant Program, and others.

A cohort of faculty committed to “parallel mentoring of PhD students and postdocs”—research mentoring plus professional development mentoring—to ensure success in securing a faculty position, and then being successful in that position.

A website that provides a customizable menu of opportunities to create an individual curriculum providing asynchronous access to professional development planning materials. The site will specifically focus on faculty positions and use existing material (http://grad.msu.edu/prep/ and http://fod.msu.edu/), as well as new materials developed by CAFFE.

**CAFFE at MSU brings together:**

NSF-funded ADVANCE program focused on faculty women in Natural Science, Engineering, and Social Sciences and a goal of alignment of policies and practices to enhance quality and diversity http://www.adapp-advance.msu.edu/

NSF-funded REU programs and the CIC-sponsored Summer Research Opportunity Program.

NSF-funded GK-12 at the Kellogg Biological Station http://www.kbs.msu.edu/education/k-12-partnership

NSF-funded BEACON science and technology center http://www.beacon.msu.edu/ focused on “evolutionary science in action” and including 4 additional partner institutions.

NIEHS training grant in Environmental and Integrative Toxicological Sciences http://cit.msu.edu/Graduate%20Program/NIEHS.html

NSF-funded FIRST IV focused on postdocs in the biological sciences https://www.msu.edu/~first4/

NIH-funded Neuroscience and Social Neuroscience training grants http://socialneuroscience.msu.edu/
Activities to date:

Postdoc orientation and professional development activities co-sponsored by Grad School, VP for Research and Graduate Studies and Faculty and Organizational Development on 9/23/09.

Michigan AGEP alliance in partnership with the State of Michigan King-Chavez-Parks Future Faculty Program…annual fall conference, held on DATE.

“Integration” meetings that include the co-PIs, plus other providers of professional development programs at MSU were held weekly. The internal evaluator observes and documents our efforts at integration. This group also met with our external evaluator to establish the goals for that part of the CAFFE evaluation activities.

CAFFE Institute kick-off event held on January 15, 2010 that brought together training grant faculty, post-docs, administrators, graduate students, and AGEP scholars. A pre-survey on the current state of knowledge of participants about professional development opportunities at MSU was administered to begin to collect data on the integration part of the grant.

A CAFFE advisory committee is being established to advise on the menu and menu gaps.

Two retreats are scheduled amongst the professional development program providers to establish the “CAFFE menu” for Fall 2010-Spring 2011. The evaluator will document our progress. The “menu” will be embedded in a website described above.

Challenge: we anticipate that the biggest challenge will be convincing faculty of the urgency and value of parallel mentoring—across both research and professional development in preparation for faculty positions. That said, we started with faculty directing training grants (who already have an interest in the careers of their students), and have had full participation thus far.

Evaluation: both our internal and external evaluators began working with us early in this process. The internal evaluator is in Industrial/Organizational Psychology—is credible with the faculty and trusted by the co-PIs.

Sustainability: CAFFE is part of an on-going set of programs at MSU for the professional development of junior scholars. These (e.g., http://grad.msu.edu/prep/) are embedded in both our budget and our web development. We already have an excellent level of collaboration amongst our various offices on campus.
Institutionalizing the IGERT Innovations at Rutgers will leverage and integrate the best practices and resources of a number of existing STEM research and training programs, including four NSF-IGERT awards. The program expects to enhance both vertical integration (enabling smooth transitions in early undergraduate through professional career stages) and horizontal integration across STEM disciplines. Furthering the I^3 theme of critical junctures, the project will focus on preparation for graduate education, transition to graduate education, and preparation for and transition to research careers in academia, government, and industry while increasing the participation of traditionally underrepresented groups. At each of these junctures, cross-disciplinary coordination and recruitment efforts will efficiently utilize existing and create new programs that broaden participation in STEM studies by traditionally underrepresented groups. The mechanisms for integrating across these programs include coordination of recruitment and admissions, matching students with faculty and student mentors, holding joint symposia across disciplines, establishing an integrated structure for graduate orientation activities, and developing a coordinated mechanism to augment graduate student education with career training and preparation. (Award: 0930134)
Re: I3: Institutionalizing the IGERT Innovations at Rutgers
PI: Phil Furmanski. Co-PI’s J. Kukor, E. Kowler, P. Moghe, M. Pazzani

**Requested report of I3 activities, September 2009-May 2010 (in preparation for JAM meeting).**
This project has been active since September, 2009.

1. **Describe an innovative and integrative activity (or activities), with supporting evidence of efficacy**

**Goal:** Facilitate the transition to graduate school: A main objective of the I3 is to create ties between graduate and undergraduate research opportunities so that effective practices developed at the graduate level can be adapted to the needs of students at earlier levels, thereby establishing robust pathways for the transition to graduate education and research.

**Activities:**
- Developed and offered an “Introduction to Research” course for freshman undergraduate students from underrepresented groups who are part of “RU-STEPed Up for Success”, a program for STEM majors from underrepresented groups designed to improve retention through summer bridge experiences, academic support, mentoring, and orientation programs.
- Established a partnership with Rutgers’s Aresty program, a center that introduces undergraduates to research, matches students with faculty mentors and provides supporting activities. We are working with Aresty to develop a web-based tool that will facilitate matching undergraduates with faculty, expand the base of undergraduates and faculty who are involved in the program, and allow for the participation of graduate student mentors. The new web tool will have information about faculty research opportunities as well as the background and interests of the undergraduates seeking internships.

**Goal:** Integrate and expand programs to train graduate students to become effective researchers, mentors and teachers.

**Activities:**
- Developed and conducted a workshop in May for graduate students on mentoring skills, targeting graduate students who will be mentoring undergraduates this summer. The workshop consisted of two presentations – one by a veteran PI with a large and established lab and the other by an Assistant Professor who had had training in and studied mentoring practices. This was followed by a panel of experienced graduate student mentors and guided small group discussion periods. The presentations will be put on the I3 website (see below) to form the beginning of a resource on mentoring training.
- Developed and offered a new series of widely attended topical workshops during Spring, 2010, using a discussion and case study format on the Responsible Conduct of Research, covering: misconduct, conflict of interest, data management, authorship, mentoring and peer review.
Goal: Develop web based tools and other mechanisms to communicate activities of the I3.

Activities:

- A website has been designed and is under development; an experienced web developer is on board; the I3 activities will go under the banner of Project AGER (Advancing Graduate Education at Rutgers). It will contain tools to enhance communication among graduate programs and to serve as a resource for sharing best practices in topics such as: responsible conduct of research, mentoring, program assessment, and recruiting. The website will also contain reference databases of NSF funded research at Rutgers to facilitate graduate students finding research projects in their area of interest and to facilitate cross-disciplinary collaborations.

- I3 leadership team (including co-PI J. Kukor, Dean of the Graduate School, and Assistant Dean C. Farber) met individually with the academic leadership of each of the 5 Rutgers IGERTs and each of the 5 major Rutgers research center partners in the I3 during Fall, 2009 to discuss specific implementation plans. Meetings were also held to describe I3 activities with the Graduate School’s Executive Committee and STEM Graduate Program Directors. Face to face meetings will continue in the form of a faculty standing committee on I3 management and implementation chaired by I3 co-PI E. Kowler.

2. A challenge(s) in project-level evaluation

- At this early stage of the project we focused on obtaining the baseline level evaluation of graduate student activities and accomplishments by surveying third year students, as outlined in the proposal. An external evaluator was hired and a detailed survey was developed. Survey administration (via an online tool) is currently in progress.

- We are also working with another external expert in assessment to develop an assessment resource center which will be available to all graduate programs.

3. A challenge that has posed a potential threat to project work, and the project's response to that challenge

No threatening challenges have been noted thus far.

4. Plans for sustaining the work of the I3 project

It may be too early to comment usefully on this issue. The plans for sustaining the effort developed so far focus on all the mechanisms outlined above, including web and other communication tools, as well as new workshops and classes. One positive force behind sustainability is that all activities are being linked to and integrated with already successful and popular programs at Rutgers, and, in addition, all are being conducted with widespread dissemination and involvement of faculty, IGERTs, STEM graduate programs, and research centers.
Texas Tech University

Integrated STEM Initiative on the South Plains (ISISP)

PI: Guy Bailey, President

The major focus of the Integrated STEM Initiative on the South Plains (ISISP) is to build a long term base where K-12 students across the 84,000 square mile region of Texas are attracted to study STEM disciplines at Texas Tech University (TTU). By consolidating the recruitment and coordination process of TTU’s funded STEM programs, the Initiative expects to enable TTU to extend and enhance the impact of their STEM outreach, especially for underrepresented populations. ISISP will reduce redundant efforts and create synergistic efficiency by centrally coordinating NSF/EHR awards from the GK-12, MSP, NOYCE, S-STEM programs, and others. ISISP will further the I³ goals of broadening participation and critical education junctures by increasing recruitment of high quality, diverse high school and community college students, by stimulating interest in STEM studies in K-12 students, by creating a formal pathway from high school to a college STEM degree, and by increasing the number of baccalaureate degrees earned at TTU by underrepresented groups. The integration across awards facilitated by I³ will enable TTU to provide more widespread outreach to rural schools and additional mentoring of STEM students to enhance retention in degree programs. (Award: 0930257)

Coordinated EHR Awards

GK-12 Graduate Teaching Fellowships in K-12 Education
MSP Math and Science Partnership
NOYCE Robert Noyce Teacher Scholarship Program
S-STEM Scholarships in Science, Technology, Engineering, and Mathematics
Integrated STEM Initiative on the South Plains

The Integrated STEM Initiative on the South Plains (ISISP) was developed to link existing STEM projects at Texas Tech University (TTU) and to provide resources to enhance those projects. The project began in late Fall 2009 with the hiring of an Assistant Coordinator of STEM Outreach. The new Assistant has been active in recruiting, coordinating distance education initiatives, and developing plans for summer math camps. A proposed TTU STEM Education and Outreach network has met and made plans to link grant writing groups and to discuss tenure and promotion policies. Some specific activities are described below under the suggested headings.

- **An innovative and integrative activity (or activities), with supporting evidence of efficacy**
  Increased recruiting for our Noyce Scholars programs has led to 26 applicants compared to 14 applicants in 2009. A specific success in this area was the application of three candidates as possible transfer students from community colleges. Three new summer math camps are being developed for 2010 and these will include content delivered via ITV from TTU to remote K-12 schools.

- **A challenge that has posed a potential threat to project work, and the project's response to that challenge**
  We had planned courses in high schools delivered via ITV. We discovered that many high schools already had such courses delivered from local community colleges and that demand is currently being met. However we have found a need for supplementary and enrichment materials in the high schools. We have been able to offer live tutoring and are currently developing a series of lectures for the summer math camps. This change has impacted the role of distance education providers on the TTU campus and there has been some re-alignment of consultant roles within the project.

- **A challenge(s) in project-level evaluation**
  The main challenge in project-level evaluation is related to the scope of the project. TTU currently has about ten active STEM outreach programs and evaluation of each is independent. It is difficult to create measures to assess the value-added impact of the ISISP program. The challenge also includes the difficulty of finding suitable control groups for any particular survey. It appears that much of the evaluation will be related to document analysis, which will verify the existence of the proposed structures and provide evidence of meetings, outreach activities, and policy changes.

- **Plans for sustaining the work of the I3 project**
  The position of Assistant Coordinator of STEM Outreach is partially funded by TTU over the course of the project and will be fully funded by TTU after the project ends. The TTU STEM network will continue. Funding will be sought to continue the summer math camps and other outreach projects. Tenure and promotion guidelines are being put in place, which will remain in force after the project ends.
Towards a Center for STEM Education

PI: Philip DiStefano, Chancellor

The University of Colorado’s I³ project, Towards a Center for STEM Education, will develop a cross-departmental distributed center that capitalizes on cyber infrastructure as well as regular face-to-face interaction to increase the effectiveness of existing STEM educational efforts. The Center will link current NSF-funded projects including CCLI, NOYCE, REESE, and REU, provide infrastructure support for smaller projects, and create a community of scholars dedicated to, and supportive of STEM education to clarify pathways across critical junctures for STEM students. The project focuses on three multi-disciplinary lines of inquiry: undergraduate and graduate course transformation, undergraduate and graduate teacher preparation, and discipline-based education research. Under the supervision and direction of the project management team, the CU I³ will expand undergraduate teaching experience programs, build graduate programs in discipline-based education research (DBER), and coalesce a community of dedicated scholars through seminars/group meetings, faculty seed funding, part-time graduate support for DBER, and evaluations of the degree of synergy achieved among individual STEM programs. In building a distributed center that retains disciplinary departmental identity, the project departs from the usual model of a separate university center for STEM education that is removed from the normal activity of science research, engineering, and education departments. (Award: 0833364)

Coordinated EHR Awards

CCLI Course, Curriculum, and Laboratory Improvement
NOYCE Robert Noyce Teacher Scholarship Program
REESE Research and Evaluation on Science and Engineering
REU Research Experience for Undergraduates
INNOVATIVE AND INTEGRATIVE ACTIVITIES WITH SUPPORTING EVIDENCE OF EFFICACY:

⇒ This NSF grant has established new campus wide awards: Chancellor Awards for Excellence in STEM Education: Faculty awards are up to $10,000 each to provide course release, summer salary, or research funding to initiate a program in educational research or to engage in research-based educational transformation. Graduate awards are 25% stipends, which are matched by the student’s department.

  - First Year: 4 Faculty awards to faculty in 3 different colleges: Engineering & Applied Sciences, Arts & Sciences and Education. Graduate awards were made to 8 students in Physics, Atmospheric and Oceanic Sciences, the School of Education, Astrophysical and Planetary Sciences, Math, Computer Science. These awards are just ending, and have resulted in at least 3 different NSF grants (by the Awardees) and significant work towards 5 PhD theses in STEM Education research.
  - The Second Year awards were just made. 4 faculty & 5 graduate students from 3 Colleges represented.

⇒ Discipline-Based Education Research (DBER) Seminars are a forum for faculty interested in STEM education research. On average, more than 20 faculty from 10 different STEM departments and three Colleges/Schools attend the weekly seminar series.

  - DBER group has advised the Colorado Department of Education on K12 science standards
  - DBER is also serving as a vehicle to make connections with STEM education experts from other institutions and has already hosted faculty from MIT, University of Maryland, University of Hawaii (H), Open University, England, University of Texas at Austin, Arizona State University, and the University of Pittsburgh, as well as US Congressional Representative Polis and his staff.

⇒ An Annual Symposium and Mini-symposium series in STEM Education:

  - First Annual Symposium August 2009: Over 30 program presentations & 150 participants, including 2 Regents, 3 Nobel Laureates, and President of the University of Colorado Foundation.
  - Second Annual Symposium Will be held in September or October. This event will include a keynote address by a leading figure, a poster session and, an award ceremony for the Chancellor’s Awards for Excellence in STEM Education.

⇒ Mini-Symposium Series:

  - Learning Assistant Workshop planned for summer 2010
  - Professional Development mini-symposium planned for fall 2010

⇒ Learning Assistant (LA) Program: high performing STEM majors are recruited from introductory courses and encouraged to consider teaching as a career. LAs facilitate small-group interaction in large-enrollment courses, supporting course transformation. Their experience includes a School of Education pedagogy course and weekly disciplinary preparation. The LA program: improves student learning for all students in impacted classes, engages more students and better prepares them to be teachers, supports institutional transformation to implement reform-based instructional strategies. More info on success at: stem.colorado.edu

  - Annually we hire 80+ LAs into 10 different departments classes in the College of Arts and Sciences
  - LAs will be introduced into classes in the School of Engineering & Applied Science in AY 2010-2011
  - We are in the midst of securing institutional funding to make this program permanent.

⇒ Diversity Efforts:

  - A student led group focuses on sending an annual delegation to the joint annual meeting of the National Society of Black Physicists & Nat’l Soc. of Hispanic Physicists. This group has expanded to create a weekly campus wide seminar series for minority and majority students to engage in STEM scholarship.

  - This NSF i-3 has led to a joint grant to NSF S-STEM from the project Directors: and the Vice Chancellor for Diversity to issue scholarships in STEM education and STEM research.

  - NSF i-3 supports a coalition of informal science education programs, Partnerships in Informal Science Education in the Community.

⇒ Policy & Publicity:

  - NSF i-3 Directors have led the formation of a Boulder Area STEM Education Coalition to build community (among the university, industry, national labs, workforce efforts, non-profits, community centers, & others), and represent the region. An official center of the Colorado STEM Network.

  - Participation & advising on State (CO) and National level STEM Education issues.

    - Directors have advised on newly revised state standards in science, and participated in the writing of the state proposal to Race to the Top.

    - Directors and PIs have advised on national Race to the Top competition, testified before the US Congress on the state of undergrad and graduate STEM education, wrote language for America COMPETES Act reauthorization, and visited the White House as part of Assoc of Public and Landgrant Universities’ Science and Math Teacher Imperative.
NSF I3 #0833364: Towards a Center for STEM Education
University of Colorado at Boulder

A CHALLENGE THAT HAS POSED A POTENTIAL THREAT TO PROJECT WORK, AND THE PROJECT’S RESPONSE TO THAT CHALLENGE:

⇒ A major challenge has been securing sustained funding for the Colorado Learning Assistant program, a core program of the NSF I3 effort. The University of Colorado at Boulder (CU) is now receiving less than 5% of its operating expenses from the State. Meanwhile, the LA program addresses national calls for reform and CU Flagship initiatives in experiential learning, interdisciplinary programs, and commitment to excellence in education. It is a cornerstone program of this NSF I3 effort.
  
  • Mid January: Many DBER faculty made personal contributions to the LA Program through the CU Foundation in order to send a strong and clear message to senior administration about funding priorities.
  • February 2: Presentation to the Dean’s Council about the LA Program — Positive responses from each of the Deans of 9 different Colleges at CU.
  • February 25: Meeting with STEM Department Chairs about fundraising — Chairs gave unanimous support for making fundraising for STEM education a priority.
  • March 11: Subset of Directors meet with the Chancellor to secure funding for the LA program for the fall — Verbal commitment was given for temporary funding AY 2010-2011.
  • June 24: Professors Otero and Finkelstein (project Directors) will make a presentation about the LA program to the Regents of the University of Colorado.

A CHALLENGE IN PROJECT-LEVEL EVALUATION:

⇒ The Project seeks to integrate efforts in STEM Education across campus, and while it is possible to identify the level of coordination and awareness of various efforts across campus, to capture unpredicted and long-term outcomes remains a challenge.
  
  • We have conducted two rounds of baseline evaluation of the project by identifying, surveying, and interviewing STEM education programs on campus to assess the level of integration and interaction between them and identify common goals and needs.
  • An external evaluator, Dr. Scherr, conducted an evaluation in August of 2009 that focused on the project’s Principal Investigators and Directors and affiliated faculty and graduate students. Dr. Scherr will be invited to conduct another evaluation in the late summer / early fall of 2010.
  
⇒ This effort, to catalyze interest engagement and communication among the STEM Education community at CU-Boulder, will have many observable and quantifiable effects in the short-run. However, the great success of this project will likely be realized well after the funding cycle of this NSF I3 expires. In ten years the landscape of STEM Education at CU will be different. Continued evaluation will be required.

⇒ Complementing the challenge of time-scales for evaluation, many of the outcomes will be emergent. We will be able to identify and seed key forms of integration of STEM efforts: however the innovative aspects (grant, programming, etc) that arise from these integrated efforts will be hard to capture (expensive) if we don’t know what to look for.

PLANS FOR SUSTAINING THE WORK OF THE PROJECT:

⇒ Long-Range Funding Plan
  
  • We have started to coordinate our efforts in branding, policy, media relations, and fundraising. A recent meeting brought together leading representatives from University Communications, Photography & Videography, Alumni Relations, Fundraising, Strategy & Branding, and Government Relations.
  • We seek to be one of the major foci of the University’s upcoming capital campaign. An initial sign of success is that the CU Foundation has assigned a representative to fundraise on our behalf.
  
⇒ Establish Center for STEM Education: To raise awareness about STEM education, manage cross-college programs, and coordinate grant and foundation work for long-term sustainability, the Directors have begun to examine options / locations to become an official Center for STEM Education at CU. We are well on our way to establishing our goal of establishing such a Center.

Contact Information:
Noah Finkelstein
Co-PI and Director, Project Management Team
noah.finkelstein@colorado.edu 303 735 6082
http://www.colorado.edu/istem
Catalyzing Institutional Change in STEM Education at the University of Florida

PI: James B. Machen, President

The I³ Initiative at the University of Florida aims to foster integration of all NSF-funded research and training programs in STEM and social, behavioral, and economic science disciplines, including AGEP, GK-12, IGERT, and GRF awards. UF will facilitate collaboration and dialogue among these projects in order to leverage the synergistic strength of their combined resources, capabilities, and experience. Catalyzing Institutional Change in STEM Education at UF will create the Program Integration Institute (PII), an independent entity providing value-added services and curricula to both graduate and undergraduate students across disciplines. PII plans to expand the overall impact of NSF support at UF by integrating the best practices of individual training grants, identifying and maximizing possible synergies, engaging undergraduates in the research community, ensuring the participation of underrepresented students in STEM, and improving interactions among existing programs. The I³ endeavor expects to generate impacts across the wide range of projects addressed by PII and to play a major role in paving critical education junctures, broadening participation, integrating research and education, and developing a globally engaged workforce. (Award: 0833439)

Coordinated EHR Awards

AGEP Alliances for Graduate Education and the Professoriate
GK-12 Graduate Teaching Fellows in K-12 Education
IGERT Integrative Graduate Education and Research Traineeship
GRF Graduate Research Fellowship
The University of Florida Innovation through Institutional Integration (I-Cubed) Program aims to foster integration of all student-based research and training programs in STEM and SBE disciplines. The primary goal of the Program is to further the preparation of students to have a true competitive edge through an extended focus on professionally-oriented training programs designed to enhance careers.

The objectives of the Program are to 1) improve and enhance interactions and collaborations between existing NSF-funded student-based programs, including K-12 activities; 2) integrate and institutionalize best practices of training grants (NSF and other) at the University of Florida to improve the professional preparation of graduate students in the STEM disciplines; 3) develop integration and synergies where possible in research, training and education programs; 4) include undergraduate students where possible in these activities and enhance their preparation for graduate studies; and 5) to ensure that students from underrepresented populations are fully involved.

Innovative and integrative activity (or activities), with supporting evidence of efficacy:

- Formed a Graduate Student Advisory Council (GSAC) which is the driving force of I-Cubed Program in shaping graduate education at UF. GSAC represents various departments and are primarily NSF-funded students. The project instituted GSAC’s regular meetings with President Machen aimed at improved communication and engaging the university president with GSAC and graduate education as a whole.

- Formed Internal Advisory Board (IAB) which represents key decision-makers across UF campus (including PIs of NSF-funded training grants at UF) to facilitate the achievement of project goals and objectives toward integrating academic and non-academic resources and opportunities for graduate students in STEM and SBE disciplines.

- Launched a program website [http://i3.institutes.ufl.edu/], which serves as a front face of the project. The website informs students and faculty on project progress and interesting developments (e.g. NSF Research Day, workshops, etc.). It also provides information on I-Cubed Program’s collaborating partners, GSAC and IAB members, and links students to other NSF-funded projects at UF. The website is currently under revision and GSAC is helping Program to design website so it can promote interdisciplinary collaboration, professional development and community outreach.

- Provided 2 travel grants for graduate students from the School of Natural Resources and Environment and Civil Engineering Department (also an AGEP fellow) to participate in the UF SPICE GK-12 South Africa Ecosystem Health Study Abroad Program during summer 2009 which was a result of supplemental funding from the NSF to the UF SPICE GK-12 project to support international research activities of UF STEM graduate fellows and K-12 science teachers in South Africa. This opportunity allowed the interdisciplinary integration of SPICE GK-12 fellows, middle school science teachers, IGERT AMW3 fellow and AGEP fellow.

- Held an annual NSF Research Day in Fall 2009. The event served as a venue for UF graduate students in STEM and SBE disciplines (primarily NSF-funded students) to exchange their research findings and network with other students conducting related research activities.

- Building partnerships with UF-based centers and programs to offer professional development training opportunities for students, including:
  - Partnership with UF Libraries and Office of Graduate Minority Program instituted a series of grant writing workshops for fellowships from NSF, NIH, Ford Foundation, etc.
  - Partnership with UF Career Resource Center and UF Center for Excellence for Regenerative Health Biotechnology helps organize career panels and roundtable discussions on best practices for career awareness and how to develop professional networks and apply research in the industrial, business, government and nongovernment and academic settings.
Partnership with NSF-funded programs at UF that helps offer pedagogy, communication, ethics and mentor training workshops for graduate students.

Established a thorough monitoring and evaluation plan with the help of external evaluator hired to conduct annual program evaluations and internal evaluator to collect baseline data on students and faculty. As a result, the internal evaluation team gathered baseline student and faculty data, while external evaluator conducted a focus group with GSAC members at the end of 2009.

I-Cubed program instituted several funding opportunities for graduate students, including:

- Interdisciplinary research project award - aimed to facilitate interdisciplinary research collaboration between graduate students in the STEM and SBE disciplines to propose, develop and participate in interdisciplinary research projects and provide graduate students with experience working in an interdisciplinary team environment.

- Teaching award - aimed to integrate research and teaching by providing opportunities for graduate students to teach at the collegiate level and attend on-campus training workshops held by pedagogy experts. The award is given in two categories: 1) awards for individual lessons that are developed and implemented within an existing course at UF; and 2) awards for course development and delivery at the undergraduate or graduate level.

- I-Cubed photo, video and writing contest – aimed to showcase students’ research through I-Cubed website. The contest has photography, video and written categories to demonstrate the scientific, technological or engineering accomplishment of UF students.

Challenge that posed a potential threat to project work, and the project’s response to that challenge:

- The UF I-Cubed program encountered a challenge of broadening and deepening the educational horizons and learning experiences of the students due to the size and diversity of UF, as well as due to the fact that various training programs and centers at UF operate in a silo-like fashion. The I-Cubed Program is working on leveraging inter-institutional partnerships through holding meetings and developing collaborations with various groups and programs. The project has also initiated student-led small-scale projects: 1) investigate UF’s capacity to broaden participation, support, and research resources for students with disability; 2) indentify various mentor programs and resources at UF and determine how to integrate their best practices; and 3) analyze UF’s strengths and challenges with respect to graduate student Family and Medical Leave Act policies which discourages women and underrepresented groups to fully submerge in science, technology and engineering disciplines.

Challenge(s) in project-level evaluation:

- One of the main challenges was to coordinate the evaluation strategy and work between the internal and external evaluators. I-Cubed Program held several meetings with both evaluators and facilitated the development of the assessment strategy that adequately evaluates project impacts given the diversity of UF campus and activities undertaken.

Plans for sustaining the work of the I^3 project:

- The I-Cubed Program is developing partnerships to facilitate the expansion of partners’ programs to reach larger student population as well as address gaps in addressing students’ professional development initiatives at UF. For example, the Program works with the UF George A Smathers Libraries Grants Management Program to offer fellowship and grant opportunities workshops for undergraduate and graduate students. The Program also collaborates with UF Career Resource Center to enhance career information on options inside and outside academia for students in the STEM and SBE disciplines. I-Cubed ensures that all activities are publicized through the UF Graduate School and Office of Minority Programs, and ensures that they are involved with program implementation. The UF Office of Research also helps I-Cubed program outreach and establish links with the prospective NSF-training grants coming to UF.
Transforming Engineering through PEERS (Promoting Equity in Engineering Relationships): Building a Better Experience for Underrepresented Students

PI: Phyllis Weis, Provost and Executive Vice President

Transforming Engineering through PEERS (Promoting Equity in Engineering Relationships): Building a Better Experience for Underrepresented Students focuses on improving the climate for engineering students at the University of Washington, especially those that face bias in their field. With an innovative approach aiming to “fix the system” rather than the student, UW expects to broaden participation of underrepresented groups by creating a cadre of change agents who will develop and encourage more equitable relationships in the academic environment. PEERS will leverage lessons learned from existing STEP, CCLI, RDE, and ADVANCE awards in increasing the retention and persistence of minority, female and, disabled students in engineering and provide a foundation for campus-wide replication. The I³ project centers on students as a key component of success, training student leaders to educate faculty and their peers about the conscious and unconscious biases imposed on underrepresented students. The project plans to enhance the understanding of widespread issues related to the inclusion of underrepresented groups in engineering and serve as a model for other universities to effect cultural change on their own campuses. (Award: 0833338)

Coordinated EHR Awards

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<th>Award</th>
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<td>STEP</td>
<td>STEM Talent Expansion Program</td>
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<td>CCLI</td>
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<td>RDE</td>
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<td>ADVANCE</td>
<td>Increasing the Participation and Advancement of Women in Academic Science and Engineering</td>
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Overview of Activities of the University of Washington I3 grant “Transforming Engineering Through PEERS: Building a Better Experience for Underrepresented Students”

May 2010

The UW I3 grant began April 1, 2009. PEERs stands for Promoting Equity in Engineering Relationships. The overall project goal is to improve the experiences of underrepresented undergraduate students in the College of Engineering, resulting in increased participation of women, minorities, and people with disabilities. This is a program for students, by students; and we have developed a cadre of student leaders who are helping us improve the UW College of Engineering and engage their peers and professors to create positive change toward a more inclusive engineering environment. Thus far, we have engaged in the following activities:

- Hosted a Capacity Building Institute which created a forum for illustrating the impact of bias and how it is manifested and engaged engineering faculty, staff, and students to determine ways to combat bias and improve the culture of engineering;
- Created a Community of Practice (listserv) to enable communication with people interested in the PEERs project and goals;
- Offered the first annual 1-credit seminar for Engineering students (called ENGR498C: Leadership Development to Promote Equity in Engineering Relationships (P.E.E.R.s)), which drew 13 engineering students;
- Selected four students from the class to serve as PEER Leaders who make presentations and pitched the PEERs program to faculty and students;
- Established a project website: [www.engr.washington.edu/peers](http://www.engr.washington.edu/peers) to highlight project activities;
- Developed a campus climate survey and focus group interview protocols to evaluate the impact of the PEERs project.

An innovative and integrative activity (or activities), with supporting evidence of efficacy

The innovative and integrative activity we would like to highlight is our PEERs seminar. (See [http://www.engr.washington.edu/peers/students/coursepage.html](http://www.engr.washington.edu/peers/students/coursepage.html).) This course was very different than the students’ standard engineering curricula. The students in the PEERS seminar were exposed to the social science literature on bias, diversity, stereotyping, and privilege. The structure of the class included lecture, discussion, small group activities, and student panels. Sample course topics included the state of engineering, why diversity is important, implicit bias, stereotype threat, privilege, personal engineering and science stories, disabilities, resistance to diversity, and how to be an ally. One highlight of the course was a panel of students with disabilities who discussed their student experiences. For most of the students in the class, this panel was their first in-depth interaction with students who have disabilities, and the students found the personal stories and perspectives of the panelists very educational and inspiring. The students presented their final projects in a public forum on December 15, 2009. In their final projects students presented some of the key concepts and ideas from the course and suggested actions one could take to improve the engineering culture at UW. The public forum was attended by over 30 faculty, staff, and college administrators, including the Dean of Engineering.
Following the formal student presentations, the presentation attendees engaged in a great open discussion with the students about what they learned.

In the course evaluations, in comments during the final presentations, and in other conversations with the course instructors, students reported learning many new ideas and concepts, being surprised by the research results presented in class, having their thinking challenged, and having a new appreciation for and awareness of the impact of diversity.

**A challenge that has posed a potential threat to project work, and the project’s response to that challenge**

A challenge that poses a potential threat to the project is seminar student enrollment. Much of the project work depends on having a good number of engineering students enrolled in the class. The more students enrolled in the class, the broader and deeper the project’s reach. Also, the PEER Leaders, who do the bulk of the project outreach and dissemination work to students and faculty, are selected from the seminar students. Without enough students in the class, we cannot develop a large enough group of PEER Leaders, hampering our outreach efforts.

To address this challenge the project has actively reached out to a variety of groups to assist with student recruitment. For example, information about the class was distributed to all advisors in the College of Engineering. College-level advisors are also highlighting the class to their advisees. The Community of Practice has been asked to recommend students for the class. Personal invitations to enroll in the seminar are sent to all students recommended to the program by advisors and other faculty and staff. The PEER Leaders are visiting student groups to make a personal appeal to take the seminar.

**A challenge(s) in project-level evaluation**

A challenge to project-level evaluation has been to construct measures to demonstrate the impact of the PEERS interventions on the College of Engineering. Monitoring changing student experiences in engineering over the five year grant period is a challenge. Based on the survey instrument from the Project to Assess Climate in Engineering (PACE), a UW campus-wide survey will be administered to undergraduates in Years 2 and 5 of the PEERS grant period to monitor student perceptions of climate over time. As part of the research design, engineering majors will be benchmarked against at least two non-engineering departments with matched demographics to help compare “nature” changes in climate to those in the College of Engineering. Additionally, interviews and focus groups with students, faculty, and staff will provide a context for how PEERS has impacted them on an individual level. Engineering major enrollment and degrees granted by under-represented group will also be monitored for changes over time.

**Plans for sustaining the work of the I3 project.**

As for sustaining the work of the I3 project, we are exploring ways to sustain the PEERs course. Ideas for sustainability include having the course permanently housed in a department and counted as part of a faculty’s regular teaching load, expanding the course beyond engineering, and including the course as part of the UW’s diversity minor. We are currently in conversation with various people around campus about these options.
Vanderbilt University (with Fisk University and Delaware State University)

Broadening Participation in Materials Science through Institutional Integration of a Masters-to-PhD Bridge Program at Fisk, Delaware State, and Vanderbilt Universities

PI: Richard C. McCarty, Vice Chancellor for Academic Affairs and Provost

*Broadening Participation in Materials Science through Institutional Integration of a Masters-to-PhD Bridge Program at Fisk, Delaware State, and Vanderbilt Universities* will expand a successful Masters-to-PhD bridge program with Fisk University to a new partner institution — Delaware State University — and a new discipline — materials science. Building upon a robust model of successful institutional transformation and integration in the disciplines of physics and astronomy, the *Bridge* project expects to increase synergy and collaboration across NSF-funded CREST and REU programs while scaling up the existing bridge program to include materials science. This i^3 award will help *broaden minority participation* in materials science and further the long term goal of expanding the reach and impact of the *Bridge* project, in which collaborative scientific research serves as glue between institutions and a stream through which students flow more seamlessly across institutional divides and *critical education juncutures*. Leveraging significant institutional support already in place, this award expects to enable dramatic increases in the production of well-prepared, underrepresented minority PhDs in materials science and lay a foundation for truly understanding how to best design the model to ensure successful portability into new disciplinary and institutional contexts. (Award: 0930018)

**Coordinated EHR Awards**

- CREST: Centers of Research Excellence in Science and Technology
- REU: Research Experience for Undergraduates
The FiskVanderbilt Master's to PhD Bridge Program

Is “Birds of a Feather Session”, NSF JAM Meeting, June 2010

PI: Richard McCarty (Vanderbilt University), CoPIs: Keivan Stassun and Sandra Rosenthal (Vanderbilt University), Arnold Burger (Fisk University), Noureddine Melikechi (Delaware State University)

By completing a Master's degree at Fisk University under the guidance of caring faculty mentors at Fisk and Vanderbilt, students develop the strong academic foundation, research skills, and one-on-one mentoring relationships that will foster a successful transition to the PhD at Vanderbilt. With I3 support, the Bridge Program is expanding to include Delaware State University as an additional PhD destination for Fisk-Vanderbilt Bridge students. The Bridge Program is flexible and individualized to the goals and needs of each student. Courses are selected to address gaps in undergraduate preparation, and research experiences are provided that allow students to develop—and to demonstrate—their full scientific talent and potential.

The Fisk-Vanderbilt Master's-to-PhD Bridge Program is intended for students who:
- have completed a baccalaureate degree in math, physics, chemistry, biology, or engineering.
- are motivated to pursue the PhD but require additional coursework, training, or research experience.

How the program works, in a nutshell:
- Earn a Master's degree in physics, chemistry, or biology at Fisk, with full funding support.
- Along the way, get valuable research experience with caring, dedicated mentors. Emerge with solid preparation for entry into a world-class PhD program, and the ongoing support of a network of dedicated mentors.
- Get fast-track admission to a participating Vanderbilt or DSU PhD program, with full funding. Participating PhD programs currently include: astronomy, physics, materials science, biology, and biomedical sciences (Vanderbilt), and Optics (DSU).

Key milestones achieved by the Fisk-Vanderbilt Master's-to-PhD Bridge Program include:
- Since 2004, the program has attracted 35 students, 32 of them underrepresented minorities (URMs), 59 percent female, and a retention rate of 92 percent.
- The first Bridge Program PhD was awarded (in materials science) in 2009, just 5 years after the program's inception.
- The Bridge program is on track to award 10 times the US institutional average number of URM PhDs in astronomy, 9 times the average

1 http://www.vanderbilt.edu/gradschool/bridge
2 Fisk University and Delaware State University are both Historically Black Colleges and Universities (HBCUs).
3 Read an article about the first Fisk-Vanderbilt Bridge Program PhD recipient: http://sitemason.vanderbilt.edu/vanderbiltview/articles/2010/02/26/crossing-the-bridge.108290
in materials science, 5 times in physics, and 2 times in biology. Our 2008 cohort alone represents a 100% increase in the production of URM PhD astronomers for the entire US.

- Bridge students have received the nation's top graduate fellowships from NSF and NASA.
- In 2011, Vanderbilt will achieve the distinction of becoming the top research university to award PhDs to URMs in astronomy, physics, and materials science.
- Already, as of 2006, no US institution awards more Master's degrees in physics to Black US citizens than Fisk. Fisk has also become one of the top 10 US institutions awarding the Master's degree in physics to US citizens of all ethnic backgrounds, and in 2010 became the #1 ranked liberal-arts HBCU in research [Washington Monthly rankings, May 2010].

Two challenges to replicating the successes of the Fisk-Vanderbilt Master's to PhD Bridge Program at other institutions, including at other major research universities:

1. Recruiting and rewarding dedicated faculty leaders. In the research university context, faculty “bridge builders” need to be motivated and incentivized through institutional and external rewards (e.g. recognition in tenure and through prestigious awards). Importantly, to date four of the Bridge Program's faculty leaders have won NSF CAREER awards (Keivan Stassun, 2004; Shane Hutson, 2006; Eva Harth, 2007; Kelly Holley-Bockelma, 2009).

2. Identifying promising URM students who may not have competitive GRE scores in comparison to the talented foreign students who apply to our programs in large numbers. The challenge, in other words, is to learn to recognize “unrealized potential” in a student, to recognize and nurture the human traits that make for a great scientist but that are not easily quantified—creativity, ingenuity, genius even. The Fisk-Vanderbilt Bridge Program does this through an “audition” approach: By the time a student has crossed the Bridge, there is no need to guess whether the student has “what it takes” for a PhD or to rely solely on “by the numbers” metrics—we know the student, have actually watched him/her perform in the laboratory. We therefore enjoy a much richer set of data about our incoming students than is usually available in PhD admissions.

A challenge in project-level evaluation. One of the goals of our I3 project is to articulate the “theory” of the Bridge Program—its guiding principles as well as its operational details—in a way that colleagues at other institutions can understand, and thereby implement. We are collaborating with the Center for Institutional and Social Change (CISC) at Columbia University to perform a longitudinal, multi-institutional, collaborative research study, focusing on the question of how the logics of merit and mission connect to the integration of our Bridge program into the larger institutional logics and practices at each of the three institutions. CISC’s research includes three levels of analysis: (1) in-depth case study analysis, (2) cross case setting analysis, and (3) examining the applicability of knowledge to new settings. The case study consists of: (a) in-depth interviews with key stakeholders and participants within each institutional entity within the case setting; and (b) collaborative inquiry to identify the cognitive interpretations used by key actors, and to understand the relationship among these cognitive interpretations across institutional boundaries.

Plans for sustaining the work of our I3 project include:

- Identification of additional new faculty leaders (“bridge builders”) at each of the bridged institutions. Incentivize participation through track record of success with CAREER awards.

- Ongoing institutionalization of Bridge Program support, especially administrative support and direct student support. The Vanderbilt Provost’s Office currently invests $250K/year for full-time administrative support and one-year Bridge Fellowships for up to four Bridge students each year who are admitted to Vanderbilt PhD programs. A goal is to steadily increase the number of Bridge Fellowships to incentivize and reward our PhD programs that develop successful new disciplinary tracks within the Bridge Program.
\(i^3\) proposals may be submitted to any participating program in the Directorate for Education and Human Resources. It is not necessary to have a pre-existing award from a program in order to submit. All programs have a common due date for \(i^3\) proposals and \(i^3\) proposal submissions across all programs will be reviewed in competition with one another.

For more information and answers to Frequently Asked Questions, visit:
