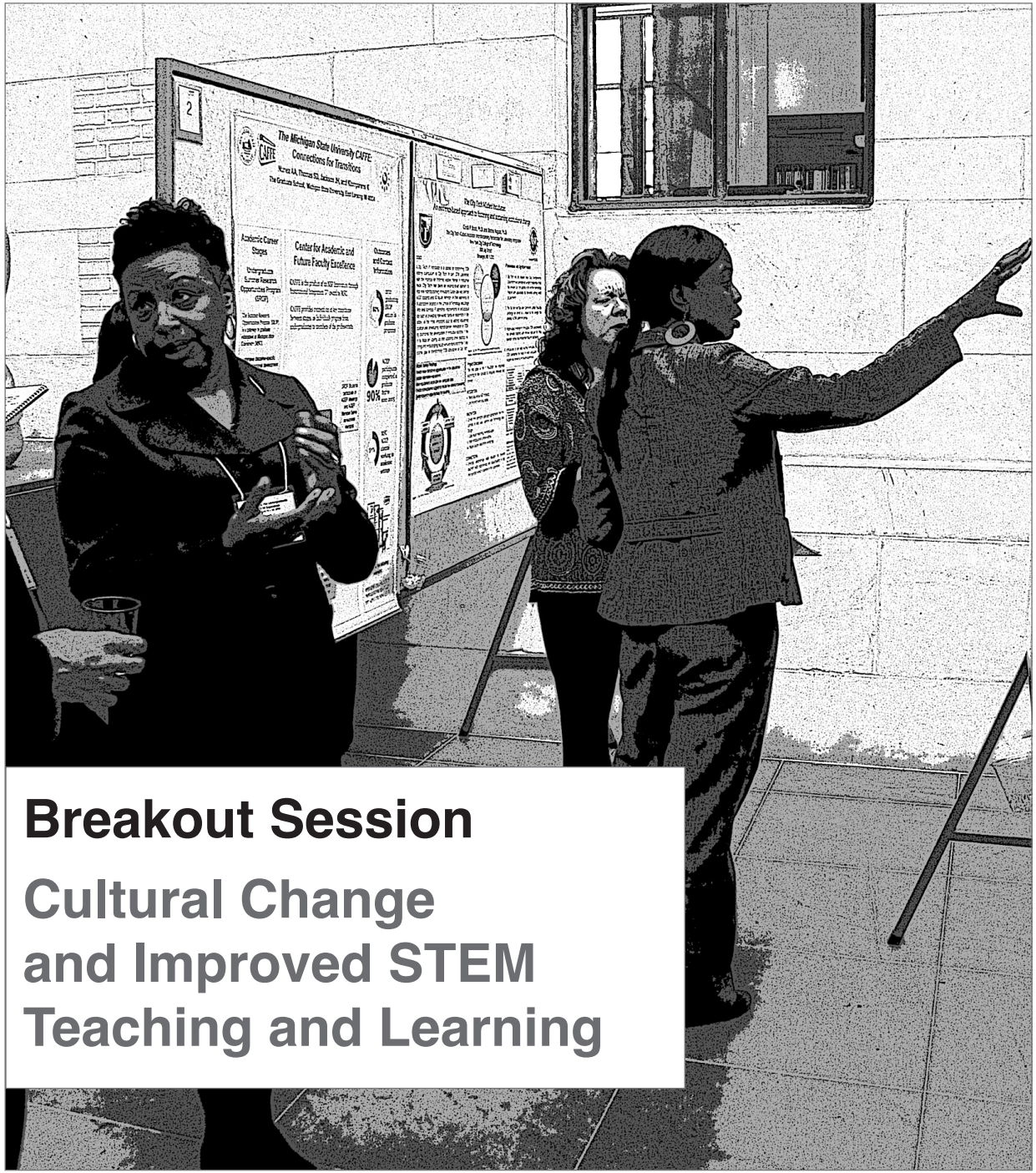

Breakout Session

Cultural Change and Improved STEM Teaching and Learning

Improving the Undergraduate STEM Experience

National Academy of Sciences
Washington, D.C.
March 13-14, 2014

National Science Foundation
INNOVATION THROUGH INSTITUTIONAL INTEGRATION

TERC
2067 Massachusetts Avenue
Cambridge Massachusetts 02140
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National Science Foundation

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nsf-i3.org/

NSF Grant #1027415

The conference was organized by TERC, a not-for-profit education research and development organization based in Cambridge, Massachusetts, as part of a grant from NSF to build an online network for the I³ projects and to disseminate lessons learned.

Participant comments have been paraphrased, they are not exact quotes. The contents of this document do not necessarily reflect the views of TERC, the National Science Foundation, or the organizations of any participants.

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Conference Documentation
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Access All Conference Documentation

This is one of a series of documents capturing conference proceedings, including the plenary proceedings and six additional breakout sessions. All of these documents may be found at the website below, as well as the original PowerPoint presentations, videos, background information on speakers and participants, and additional conference materials.

nsf-i3.org/conference/

Cover photo:
Conference poster session

PROJECT OVERVIEWS

Tech to Teaching

- Georgia Tech has no college of education or formal pathway for anybody to become a teacher, but we are a primary producer of people with STEM degrees in the State of Georgia, so our program has a two-fold purpose. One was to change the culture at Georgia Tech from the idea that teaching is a booby prize career path to the idea that it is actually a successful career path. The second was to provide programming and support for both K-12 and higher education teacher prep programs. For people who choose to follow that career path, we can help prepare them so they reach for that career path into the launch year.
  - Donna Llewellyn, Associate Vice Provost for Learning Excellence, Georgia Institute of Technology
  - Marion Usselman, Associate Director, CEISMC, Georgia Institute of Technology

Institutionalizing the IGERT Innovations at Rutgers

- Our project focuses on graduate education, including graduate student professional development and connections between graduate students and undergraduate research, and on training graduate students to be better mentors, better writers, better researchers.
  - Jerome Kukor, Professor and Dean of the Graduate School, Rutgers University
  - Eileen Kowler, Distinguished Professor, Dept. of Psychology; Associate Dean of the Graduate School, Rutgers University

STEM Central Station

- STATION is an acronym for Strategic Transformation Aligning Teaching, Immersion, Outreach and Knowledge. It fosters STEM student success by addressing critical junctures for students, faculty, and the university; and we use a lens of self-authorship, [Baxter Magolda's] framework in which students make the transition from external motivation to more internal, intrinsic motivation in their identity development. Partners can participate by developing learning partnerships in the classroom and outside of the classroom to encourage that kind of student development.
  - Patricia Pyke, Director, STEM Station, Boise State University

Catalyzing Institutional Change in STEM Education at the University of Florida

- We were in the first I^3 cohort, so of course we went after all five objectives, which was a little challenging. The conference funding panel talked about risk, and we realized we couldn't address all five mid-way through. We are now in a no-cost extension. We focus on graduate student professional development and at the time had quite a number of NSF training grants, and it had become obvious to us that professional development of graduate students—giving them teaching opportunities, learning how to write, learning how to communicate—was the big piece missing from

Breakout Group Facilitator

Bonne August

Provost and Vice President for Academic Affairs, New York City College of Technology

This is one of three breakout sessions addressing the conference's three overarching questions. The sessions draw on the experience of I^3 projects to date as participants share programs that have been initiated, lessons learned, challenges, strategies, and possible future initiatives. This session addresses the following question:

What are the innovative policies or processes that have created cultural change on your campus and have improved STEM teaching and learning? How can we design future programs to collect evidence of effectiveness?

Investigating Institutional Integration and Innovation in NSF's I³ Activity

• We have a research I³ and are trying to understand the process by which integration is occurring in the I³ grants and look at factors that facilitate or hinder the integration and synergy taking place. We are working closely with six of the grants to follow them over time. We have attempted to get some broader looks at what is happening across the grantees through a survey I sent out last year. I've been noting those of you who are in your last year. We would also like to have more contact with the projects that we haven't been following over the past three-and-a-half years to debrief with you now that you are coming to the end and get your reflections on what has helped and what has hindered, so that we can build a broader picture of what can happen and what has being learned through this incredibly interesting and innovative program.

• **Joy Frechtling, Vice President, Westat**

the graduate student preparation. Our link to undergraduates was to provide opportunities for graduate students to mentor undergrads and for undergrads to work on interdisciplinary projects with graduate students.

• Sandra Russo, Director, Program Development, University of Florida

The City Tech I-Cubed Incubator Interdisciplinary Partnerships for Laboratory Integration

• Our project uses the City Tech I-Cubed Incubator as a model for institutional change.

• Bonne August, Provost and Vice President for Academic Affairs, New York City Institute of Technology

• Cinda Scott, I³ Program Manager and Project Coordinator of Integrated STEM Projects, New York City College of Technology

Center for Academic and Future Faculty Excellence (CAFFE)

• Our I³ grant is in its last year. The main mission of the grant was to integrate a variety of projects that should have been linked from the beginning, but given a place like Michigan State that is large and decentralized, they were operating without connections. The grant also focuses on preparation for future faculty and connects the professional development of undergraduates with learning communities that exist for graduate students.

• Antonio Nunez, Associate Dean, Michigan State University

Aaniiih-Nakoda Environmental Excellence Center

• Our focus was on integrating STEM programs throughout the college and to centralize undergraduate STEM research at our college and to infuse culture into our curriculum.

• Participant

I³: Strengthening the Professoriate at Iowa State University (SPISU): A Campus Network to Enable Science & Diverse Communities

• We have a focus on faculty development and institutional infrastructure, especially in relation to the broader impacts criterion. We are trying to synergize across the larger NSF grants on campus to leverage some of the broader impacts work that they are doing as well as what other programs on campus are doing and really get faculty aware of those broader impacts opportunities and build them into their own research proposals. Ultimately we want faculty or even graduate students and post-docs who are future faculty to be able to plan better broader impacts, write better broader impacts, and evaluate their broader impacts.

• Diane Rover, Professor, Iowa State University

• Participant

I³: A Cyberinfrastructure and Communication-Based Model to Foster Innovation that Broadens Participation in STEM Fields through Institutional Integration

• Our project is called Broadening Participation through Cyberinfrastructure, Communication, and Connection.

• Participant

I³ Berkeley Science Connections Program

- Our project focuses on increasing diversity in mathematical, physical, and computer sciences, specifically through a series of linked opportunities for research for students, and it targets those transitional years from the upper division at the undergraduate level through the first couple of years of graduate education, more or less up to the qualifying exams. • Participant

FIRE UP (Faculty Integration, Research, and Engagement in Urban Polynesia)

- Prior to being at NSF I was involved in an I³ grant called FIRE UP at Kapi'olani Community College in Hawaii. We had a lot of success with students in broadening participation in STEM. We have actually had explosive enrollment increase but found that the faculty were not coming along at the same speed. Our I³ was focused on trying to get faculty engaged in the model and helping to support this. We took all of the programs we had for our students and brought it together with our faculty to see if we could get both lines in parallel.
  - John Rand, Program Director, National Science Foundation

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

- The I³ grant was a first step in institutionalizing undergraduate research at Hunter and provides institutional support for STEM undergraduate enrichment programs funded by federal agencies or through other programs. In moving forward beyond this grant, we are hoping to institutionalize our efforts around undergraduate research more broadly and across disciplines. We just had our second annual undergraduate research conference last year, a Hunter community based event that is meant to be a culture change and celebrate undergraduate research endeavors across the disciplines.
  - Rachel Verni, Director of Undergraduate Research, Hunter College - City University of New York

Enhancing Global Research and Education in STEM at Spelman College (G-STEM)

- In collaboration with the I³ grant and US Department of Education Title III funding, we support students in the STEM disciplines who want to engage in international research experiences.
  - Kai McCormack, Associate Professor, Spelman College

Innovation through Institutional Integration Projects: OASIS One-Stop Academic Student Integrated System

- We are a private HBCU in the middle of the city of Charlotte, North Carolina. We enroll approximately 1,400 students, 323 of which are STEM majors, a great number. Our retention rate ranges from 86% to 92%, so we are doing something really good. I serve as the administrator for the HBCU-UP program, therefore I am representing that institution with I³. Our I³ ended as of October of 2013, but we are moving on with what it was doing and have sustainability in many of the program areas.

AAU Initiate Helmsley Grant: Rewarding Teaching and Learning at Research Universities

- I have nothing to do with the I³ grant on our campus, but I am PI on an AAU initiative grant which is funded by the Helmsley Foundation. There are eight universities and the overall charge on these grants is to change faculty culture to reward teaching and learning at research institutions. The AAU STEM Education Initiative involves 32 institutions who are loosely organized, and then eight institutions that actually received funding, and we are in the first year of that.

  What we did is take a kind of backwards view of this. I'm a chemist and I know that imposing from without a mandate to change the culture is not going to help. Michigan State has a ton of faculty resources. If you wanted to value teaching and learning it wouldn't be hard at all. So our proposed project was that we would change culture from within. The grant is called Creating a Coherent STEM Gateway for Teaching and Learning in STEM, and we proposed to reform all of the introductory STEM courses by engaging faculty in discussions about what are the big ideas of the discipline and what would you want your students to be able to do with it. We are trying to get this idea of infusing content and practices together, which will then require a change to be made in the way that they teach. We are gathering a lot of baseline data.
  - Melanie Cooper, Lappan Phillips Professor, Michigan State University

Cultural Change

• I have a strong interest in issues related to cultural change at universities. We've had two major NSF MSPs, working on curriculum development in partnership across multiple institutions and with a school system with 130,000 students. Trying to get faculty rewarded for that is a challenge. We are just finishing up a large MSP working with six institutions and the largest minority population school district in Maryland, Prince George's County. While we didn't get an I^3 grant because the University System of Maryland doesn't have the capacity, in fact leveraging the capacity of institutions in that system means that we are doing I^3 all the time as a system, moving research universities together with comprehensive universities and community colleges. I think the broader impact issues that were raised were probably one of the most important leverage points for getting recognition and sustainable culture change.

• **Nancy Shapiro, Associate Vice Chancellor for Education and Outreach, University System of Maryland**

National Science Foundation

• I am really enthused at hearing what you have all produced. I've learned a lot and I hope I can gather that and translate it to my colleagues.

• **Participant**

We have a program, the One-Stop Academic Success Center for Integrating Students in STEM (OASIS). We chose that very carefully because in the middle of John C. Smith University sits the Carnegie Library, which was given to historically Black colleges many, many years ago. The university built a new library with all the fandangles, and this program was handed the old Carnegie building. So One Stop provided opportunities for all of the STEM-related student support services to be centered there. If you ever come to Johnson C. Smith and you drive in, everybody knows where the STEM students are. That's I^3.

In that program we have assigned each one of those 323 students to a STEM coach, and they coach them from gateway, from entrance, all the way through. We have first-year coaches and then they move right on, so everybody gets to have a coach as they are moving through. We maintain a database and all of that good stuff that you're supposed to do.

Now the Duke Endowment has financed a STEM center for Johnson C. Smith that will overlook Charlotte. The facility will be transparent and you will be able to see all the way through, and we are going to be doing research and all kinds of good stuff in there. Last week we had a "beaming ceremony." The contractors were ready to put the last beam up on the top of the building, so all of the students in STEM and all of the faculty and all of the community came to sign the beam. The beam has gone up, and we will be moving into the building in September of 2014.

• Janice Kennedy-Sloan, Program Administrator, HBCU-UP, Johnson C. Smith University

Integration of Education and Mentoring Programs at Louisiana State University

• We have a number of different educational programs on campus and our I^3 program focuses on integrating the common activities in all of those programs. We've found that to be extremely useful because there was a lot of duplication on campus and now we can do bigger and better things for all of them.

• Isiah Warner, Vice Chancellor of Strategic Initiatives, Louisiana State University

POINTS OF FOCUS/POINTS OF CHANGE

- As people offered their project descriptions there appeared to be various points of focus. Some are focusing directly on the professoriate, some on the path to the professoriate. Some are focusing on the intro to STEM, how people come into STEM in the first place, and some on a student experience that may be a little past that, on undergraduate research especially, and experiences that might keep students in STEM or help to cement that part of their identity that connects with their discipline.

  What kind of cultural change is being addressed? Is it institutional culture, is it student culture, is it principally a faculty culture? • Bonne August, Facilitator

Changing Faculty Perceptions of Summer Outreach Program Students

- I have an example that is relatively focused and has had a transformational impact. We have had for many years a summer research program for undergraduates that recruits students from outside MSU to come and do research in the STEM fields in the summer. For many, many years that was housed in student services and the perception of the faculty was that those students would come and work in the lab and would improve, but they never saw them as potential graduate students for their programs. The faculty attitude was one of social service rather than recruiting these students for their programs. A number of years back as part of the I^3 process, that responsibility was transferred to the graduate schools. We engage faculty in a totally different way and say, "Okay, you are going to help us select these students with the bar set at admissibility to your program." That has changed the perception of the faculty towards that kind of summer program. They now see it as a recruiting tool rather than as a service and social commitment type of activity. The impact is hard to tell because it is short term, but the number of students who end up in graduate school, if not with us then elsewhere in peer research institutions has gone way up and I hope we can sustain it. In terms of a change in culture, I think that has been ongoing in terms of the faculty seeing these as tools for their own research programs, for writing their own individual research grants and training grants. • Tony Nunez, Michigan State University

- These are your students in the summer program? • Participant

- No, they are all from outside MSU. Some come from New York. • Tony Nunez

Engaging Faculty in Diversity: Leadership and a Community Organizing Approach

- In changing culture, which we have been incredibly successful with at Berkeley in recent years, particularly faculty culture, I think the key element that has served us is enormously energetic personal leadership from a very high position, namely our dean in the mathematical and physical sciences. This is not just traditional, standard order leadership and I'd like to offer a short story. At a certain point the dean and I sat down to think about our I^3 project and another privately funded project we leverage along with I^3 called Berkeley Science Network. This was in response to a comment made in our external I^3 advisory board where people said, "You have to have the faculty on board to really do what you're trying to do, and we aren't so sure that can happen. Your faculty might not engage in the way that you would want around diversity issues."

  We took that as a challenge so we sat down and we put together a list of everybody across our division and in the chemistry and computer science departments who we thought among the faculty could be persuaded to engage if approached in the right way. We came up with a list of about 80 faculty, so already we had more that some would have thought. Then we looked at this as a community organizing project. We thought about how we could engage each of those faculty individually in the project around diversity. We did this in part by trying to give people information that we knew had persuaded us. For example, we distributed copies of Claude Steele's book, *Whistling Vivaldi*, along with a letter from the Dean to every member of our faculty in mathematical physics and physical and computer sciences, encouraging the faculty to read this. We then invited Claude Steele to come and urged our faculty to come to this talk, which they did. We had an overflowing room in one of our huge engineering lecture halls. Three-

Changing the Culture of Graduate Education

- At Rutgers one of the chief goals of the I^3 is to focus on graduate education, so you are talking about cultural change. I'll give a couple of examples. We set up two courses, one of them in writing and one which is called "responsible research" but goes beyond that to discussions of navigating through graduate school. Initially we advertise these things and few people show up and so on, but what happened is that we cannot handle the demand any more. There are some other activities but I am closest to these two. The demand for these activities is not just coming from us it is coming from the work, which basically is making graduate students aware of the enormity of what they have to be able to do when they leave and how so many things cannot be provided within the disciplinary programs. So we are serving an important need.

  We have also built communities among the students. These are activities in which they get to know others who are facing similar challenges, and they can discuss the things they feel they need to know and grapple with. We are working with the administration in finding ways to expand and sustain this with the goal that every graduate student has these activities before they leave, and gain some recognition of this.

  It is an important piece in this whole picture of how you transform STEM education at the undergraduate level because these are the students who are going to be out there being the next set of faculty, being the researchers. There really needs to be a rethinking on a broad scale of PhD education because the current models will have to change to meet the new demands, and these processes and changes will help.

  • Eileen Kowler, Rutgers

quarters of the room were STEM faculty and graduate students.

So we started to infuse some of the knowledge that informed our passion around increasing diversity and saw some effect from that. We are now at the point when we do events, including retreats off campus overnight, that we have to turn faculty away who want to engage in our projects. We are now working on another project with other institutions where we see that the capacity for that hasn't necessarily been built. You have to actually build that capacity.

I wanted to put that out there because it's not a policy. We didn't do anything that looks remotely like a policy. I couldn't have told you in advance that this would be the intervention that would work, and it certainly wasn't written into our proposal. I want to make the case for the importance of having faith that the thing that got you to the point of believing what you believe in will be persuasive to others if you articulate it, express it, and open a window on what you know to others. The same persuasive evidence that got me or my dean to where we are could get many if not all of our faculty to the same place. • Participant

- So this is the cultural changes involved in engaging faculty in broadening participation, and I liked your use of the term community organizing. It's a nice shorthand for all of the things that you said. And I agree that it's helpful to focus on processes. Policy is much harder, as some of us found out in our discussions during an earlier breakout session.

• Bonne August, Facilitator

Shift in Community College Faculty: Producing STEM Majors

- There was an extremely strong cultural shift that took place at two-year colleges that happened at our I^3. At community colleges the culture has been, and for many still is, that they are a math-science service department for transfer to large programs. We teach kids whatever they need in terms of basic

Working from Top, Bottom, and Middle; Finding Points of Entry

- That's a beautiful story of how organically it developed. I want to speak to the policies. One thing that we have found that has been helpful for us is to have a combination of both bottom-up and top-down processes. Like Florida, we decided we were going to try to do it all, so we didn't have one particular method. We did have, from the policy standpoint, things like the provost promoting STEM as the only group of majors that is in our strategic plan for 2012 to 2017, but then we had a lot of faculty learning communities formed for the faculty, lots and lots of opportunities and doorways for the faculty to plug in, sort of the bottom-up approach. Then we had a sort of middle approach also, which involved more of the services for students, looking at our registration systems or our data systems, or even our foundational STEM courses and how can we make those better or easier or more accessible or more effective for students. We've added learning assistants. There are lots of entry points for students and faculty. I won't give an overview of many activities, but we found that the sort of organic bottom-up works, and some of the top-down works. • Participant

- I think when you provide multiple points of entry you are not persuading people to do something they do not want to do, you are tapping into a desire to do something. Our faculty really want to engage in issues related to diversity. They would like to see science be more diverse, they want that. It's a question of how to engage them in ways to participate, points of entry, and some capacity building. • Participant

Policy and Curricular Paths: Introducing an Education Minor

At Georgia Tech, where we don't have a college of education and that is not something that is seen as an academic discipline but a service, we have gotten acceptance at the doctoral level. All of our PhD students have to do a minor. Usually, for instance, in aerospace engineering you do a math minor, you do something that is directed towards research. We now have a higher education minor, so we have students across engineering and science who are doing their doctoral minor in higher education. They are taking courses and learning about teaching and learning, about policy, about issues in urban education, etc. At the undergraduate level we are starting the discussion about having an undergraduate minor in education through our liberal arts college, which is a much harder deal that has to go through our board of regents. So policy and curricular paths is a big deal.

• Georgia Institute of Technology

requisites to move on, and they will then become science people when they transfer. I think the shift that was clearly made with this program in terms of culture is that the faculty began to view itself as producing majors at the community college. That is an enormous shift because now all of a sudden they are empowered to be able to say, "I can actually do undergraduate research in my college, and I can start to write grants to the National Science Foundation and other places."

By doing this project and getting the faculty engaged in rethinking how they are viewed as faculty at the college and in the broader community, we saw a shift from a service department to a department that had majors. Generally, while we used to give AA degrees and AS degrees, we developed a new degree program called ASNS, an associate of science in natural sciences, which began to produce majors at the sophomore level, and even at the freshman level. Kids were much more engaged in science and then the faculty got a lot more engaged. It was a big, huge shift in the culture. • John Rand, FIRE UP, Kapi'olani Community College (Currently with NSF)

- The notion of new degree pathways is a policy change. That is a tremendous focus. We had that experience in Maryland. Instead of an ASNS degree it was an AAT, an associate of arts and teaching. It is articulating pathways between community colleges and four-year colleges that are aligned, that allow students to go seamlessly from one to the other. We know from research we have done that students who get a two-year degree in which all of the credits are transferable are much more likely to complete a four-year degree, rather than coming in with credits, some of which count and some of which don't count.

  It takes a lot of grassroots work, and what we did with the AAT was get faculty from all of the colleges and universities in the state together to agree on what the outcomes of such a program would be, which meant that the majors where we were making those alignments had to agree on what the students' capacities and skills should be coming into their programs. And they don't all agree. They don't necessarily agree about what the standards are and what they want their students to know. That conversation is transformative at the policy level. I wonder how many other states or organizations have been doing that. • Nancy Shapiro, University System of Maryland

Grant Synergy and Coupling to the Research Mission

- Echoing the top-down, bottom-up idea, we had an ADVANCE grant that put in place a top-down, bottom-up structure. Our I^3 really did leverage that and we had some channels that were already established within the university that we've been able to take advantage of in our I^3 to try to hopefully effect a longer-lasting change. It was mutually beneficial because it sustained those channels that

had been built through ADVANCE and they continue.

I would also echo the thought that if you want to try to change the culture, tie it into something that is important, especially the research enterprise. Some of our broader impacts work was a little serendipitous. We didn't have our provost as the PI of our I^3 grant at the time because she was on the National Science Board, so our vice president for research is the PI on our I^3. It turns out that with broader impacts being a criterion on NSF proposals, it's beneficial to have the VP for research as the PI. And on our advisory board, we have all of the associate deans for research from all of our colleges. It has been very tightly coupled with the research mission on campus and across colleges, and that provides direct connections to faculty and across colleges. A lot of faculty and administrators see the range of broader impacts work we've been discussing and want to know what departments to partner with on campus, what centers already have established practices that they can build on. It creates a lot more momentum than you could get otherwise. • Participant

Visible Change: New STEM Centers

- We had a faculty exchange with Kapi'olani, and we specifically wanted to see their STEM center, so we sent four faculty and went there and had a nice tour and saw how it functioned. It was really impactful. We came back and gave a presentation to the deans and to Bonnie about the importance of their STEM center, specifically for them in terms of trying to infuse culture into the research for their undergraduate students. We are in the process of talking about a STEM center and brought it to the attention of the academic advisory council and they had a meeting at which Bonnie said, "What is it that we really need?" knowing full well that we had this presentation ready. What came out of that was people saying, "We need a one-stop shop, we need a place where students know they

Visibility of Change

- Is there a new center or structure? How is the change being made visible? The Johnson C. Smith example of a new center and having everyone in the community sign a beam in the construction of the new building is a proactive way to change the culture. While a strategy like this may be highly effective at a small college, how would this translate to a large university? • **Participant**

Transformative Synergy with Other Grants

- How many of you had ADVANCE grants? [A number indicate they have.] For those who don't know, ADVANCE grants are to advance women in STEM, women faculty specifically. It is not student focused it is faculty focused. ADVANCE institutions, in my experience, have found it to be a transformative grant. Although the focus is specific, the processes that people have put in place and used to create situations that are advantageous for women inevitably involve cultural change. • **Bonne August, Facilitator**

- I think it's really important for NSF and others to know that sometimes there is a synergy between programs. When that happens, that is a learning for the funding agency. • **Nancy Shapiro, University System of Maryland**

- Similarly, I wondered how many in the room had AGEP grants. That whole thing that you were just identifying about institutional transformation has been so difficult for all of us to grasp and particularly to learn how to measure, so that is exciting. • **Participant**

- It lifts it up to the next level, it magnifies it exponentially. I'll give you an example from the ADVANCE grant at the University of Maryland. We are right in the middle of that and I am on the advisory board. When the center wrote a note asking what salary ranges were in various departments, the departments had to reveal those, making it transparent, and all of a sudden, change. Now that is a very important, private, personal power lever, but making it public changed the conversation about a lot of things, not just about ADVANCE. So I think that putting in place conversations at the campus level allowed for more kinds of change to happen. • **Nancy Shapiro**

Structures Symbolizing Change

- I want to talk about something that relates to that beaming ceremony at Johnson C. Smith University, and structures that symbolize change or coalesce the various energies. In at least two of our case study grants they have now established some kinds of STEM centers that weren't there before. They are STEM centers for faculty to come together to do research, to support research. In at least one other, Kapi'olani, there does seem to have been some new attention given to the establishment of a STEM center for students where they can come and dialog, be with each other, and get assistance. And this sounds like what also happened at Maryland, there's a new structure. I'm wondering in how many of the other I^3 projects there has been something like a new structure, a new place in the hierarchy, a new place for people to come together. In how many of your grants has something like that occurred and do you think they will last? • Joy Frechtling, Westat

can get the help that they need," and this seems to be something that the faculty really want. Whether or not it comes to fruition, what pleases us about the I^3 part of it is that we have this actually being talked about, which was not talked about before. • Cinda Scott, New York City College of Technology

- There is another example of how an institution culture can change. At this small college we can move things a little bit faster and we've got the STEM center for the students, and of course it's going to be looking right at the new building where the research is going on, so it's becoming a community there and that's by design. But right in the middle of all of that, this institution was awarded a Duke Endowment grant to look at institutional transformation and hired the Blue Ocean Strategy Group to come in and look at how we could become a "blue ocean institution," rather than everybody clamoring in the "red ocean," so we've gone through a year of that. My point is, as a result of the blue ocean and all of that taking place, and the one-stop STEM center and all of that taking place, simultaneously, the recommendation has now been made that

Assuring Center Use by Integrating Intro Labs; Strategies for Interdisciplinary Synergy

- This isn't a direct outgrowth of our I^3 but we have definitely synergized with it. We've had a new building on campus for two years that took 10 years of planning, an undergraduate learning center, and being Georgia Tech, STEM is at the center of everything that we do. It is sort of an intellectual home for our first- and second-year students, and one of the early concerns was how to make sure they know it exists because it's where all of our tutoring is centered, all of our academic support. Every student at Georgia Tech takes two lab sciences, so the thought was that if we moved all of the introductory labs into this building, then every first- and second-year student will know this building exists because they'll take classes there. It's under the dean of the library who says she is the only dean of a research library in the country who also oversees all of the intro science labs. Our unit is in there, our tutoring center is in there, our communication lab is in there, and the dean of the college of sciences hired someone to be the interdisciplinary science coordinator, whose job it is to find synergies across the sciences. She puts out a newsletter every week that says here's what's going on in the intro to bio, chemistry, physics, and earth science classes so that the folks in chemistry actually know what the biology folks are teaching this week, and she highlights ideas faculty might want to talk about that synergize. So it's not top-down, "Change our labs to be integrated," but if you know the same principles are being discussed maybe you will do it. It's exciting to watch this happen. • Donna Llewellyn, Georgia Institute of Technology

other colleges at the university follow the same pattern: centers, data collection, the whole nine yards. It's at our board of trustees now. • Janice Kennedy-Sloan, Johnson C. Smith University

- With the STEM center at Kapi'olani, one of the things that we did very intentionally was put faculty offices so they would be right in the center, so it's not just a student center but a faculty center and encourages the students to see them now as science faculty not just service faculty. That really became effective because the faculty started interacting and started to get synergy and started to understand that they could write grants. That was a very powerful thing and it was kind of an afterthought. • John Rand, Kapi'olani Community College (Currently with NSF)

- You asked whether these structures would last and I think it's less important that they last and more important that they evolve. For example, at the University of Maryland they have recently decided to create a center similar to the one that I'm directing, looking at academic transformation across the university by pulling together previous legacy structures. There are faculty development people, there are learning analytics groups, there are information technology people who were dedicated to instructional design. There's an evolution of something that had pockets of people in these structures at one time that now has evolved into something else. I'm frankly hoping that at some point we won't need a center for academic transformation, it will have happened and we can move on to the next thing. The same with these STEM centers and some of these other efforts. The structure may last but the activities become focused on something else. • M.J. Bishop, University System of Maryland

Locus for Innovation: Physical and Virtual

- In talking about places, it is not necessarily physical places where people can become engaged with each other. As I mentioned, the cyberinfrastructure is one of our focal points on our grant so I would keep that in mind. There could be one-off opportunities that are coordinated with a specific purpose to bring people together around a specific research area or area of engagement that has wider scope, such as undergraduate research. I would keep that in mind too, that these physical places can exist as well as these cyber-places. • Participant

- Because we are a commuter school we think a lot about what we need to decenter. On the one hand we need centers and we need places for students to identify with, but we also need things that they can access from other places, and that is true of our faculty too. • Participant

Principled Adaptation

- There is a term that I heard at an advisory committee meeting last week. People were contrasting fidelity with adaptation, and the term was "principled adaptation." The idea is that it's for the same goal but adapting to the conditions that have changed around it. • Participant

Demonstrating Effectiveness

• It is not news to anybody that we need to demonstrate effectiveness of what we are doing, both so that we can use that information to make changes and move in needed directions, but also so that we can justify the investment that's been made in the innovations that we've put forward. What are ways that people are doing this or anticipate doing this? What are obstacles to doing this? How are you or how do you plan to demonstrate the effectiveness?

• Bonne August, Facilitator

EVIDENCE

Obstacle: IRB Approval for Data Collection

• One of the things we wanted to do was track the students who go through our program. Like everyone else we offer a lot of things and we wanted to see whether there was a dosage effect. Did it matter that some came to one workshop or took three classes and went through our certificate program? One of the main obstacles was getting IRB approval for us to be able to track these students. And it wasn't just warm bodies, we needed to know their GPAs, their gender and ethnicity demographics, whether their major changed along the way. We really needed their whole academic history. We would never publish that information, but in order to track longitudinally we needed it. It took the better part of a year to convince the powers that be that we had need-to-know to get this data. They wanted to know how we would get this data and who would clean it an in what way. And this is all internal, at one institution. I'd hate to think if this was across multiple institutions. • Participant

• I wonder to what extent your problem stems from the fact that you don't have a college of education that was asking for this data.

• Participant

• IRB is an obstacle. We are not drawing blood, we are simply asking, "Did this class have an effect on your learning?" We are not even asking personal questions. • Participant

• In some universities it doesn't matter, even with robust schools of education and everything in the spectrum in the social and behavioral sciences. The IRB is a thorn in everyone's side because they think you are drawing blood. • Participant

• It is true that it is extremely slow. They end up letting you do what you want to do, but by the time they let you do it you've had five new ideas. • Participant

• And FYI, if you are going to be submitting a new grant proposal to NSF, the IRB has to be attached to it. You want to create your baseline using the grant because if you don't get the money you're not going to be able to do the intervention, but you need to spend your own money to get all of the instruments approved before you submit your proposal. And your RFP window is small. • Participant

• I think we're all thinking about it and struggling with it from the same perspective. From where I sit now, the institutional officer's perspective, it means looking within the overall structure of the sponsored research office at the vice presidential level and realizing this is a reality from the funding agencies today. We don't have any degrees of

freedom, we have to do that. You've got to have a mechanism for how to have the money available to do that part of the study, even though that part of the study is going to be funded by the NSF, because you have to have the information to be able to get through the IRB before you can submit the grant. You just have to have rolling dollars in house to make that happen because the funding agencies simply won't let you do it any other way. • Participant

UC Berkeley: Comprehensive Student Survey

- We have a pretty comprehensive survey where we look at the milestones on the academic path that our students are taking, and we deliver it to both undergraduate and graduate students because our project traverses both populations. We obviously over-sample underrepresented minorities and women who are in the mathematical, physical, and computer sciences. That means basically every underrepresented minority student we invite into the study, so that we can get any cohesive numbers. Even then we have such small sample sizes that we are going to have a really hard time disaggregating because you disaggregate to a point that isn't particularly meaningful.

The survey includes these milestones of achievement and it also includes psychological measures. We've done this by collaborating with a professor in psychology, Rudy Mendoza-Denton, who works with us on all of the psychological factors, and then we ask permission from students to pull their student records. We did have to go through the IRB process. • Participant

Challenge: Tracking Faculty and Staff Collaborations

- Surveying faculty and staff is a challenge as well. We were looking at faculty either partnering with other faculty doing broader impacts, working with broader impacts experts on faculty, or working with broader impacts experts on staff. Nobody really keeps track of that and it's hard to survey and get responses. We've been thinking about whether there are ways we could use our proposal processing system to do better because we do check off who we are working with. Maybe there are ways we can do a better job of keeping track of these broader impacts initiatives via a checkbox. We are thinking of whether we can track that way even to the point of asking whether they are working with a specific program so that we can better understand the collaborations. • Participant

Existing Large Databases; Teasing Out What Works

- I was recently at an AAAS workshop and there was a woman from the University of California and they've been using NIH MARC data for minority students as a tool that allows you

Challenge: Survey Exhaustion and Communication Overload

- There is issue that has been a real challenge for us and we have found ourselves inventing new recruitment methods. Once students open the survey they take it and fill it out to completion. The challenge is getting them to simply open the e-mail. I don't know if this is a Berkeley issue specifically, a large school issue, or just a general issue, but for our students the survey exhaustion is just huge, and not just survey exhaustion but complete communication overload. It is extremely difficult for our students to figure out what they actually ought to pay attention to or not, what the difference is between this and a survey on how they like the e-mail system. And this is a nuance regarding the IRB which is, what are you allowed to tell people in order to recruit them into the survey in the first place? • Participant

- While looking at the conference posters, I was talking to someone from UMBC because I was interested in what they were doing. They were looking at different components of their Meyerhoff Scholars program to see if there might be lower cost ways that they could support students in STEM. What I was told was that the biggest challenge was recruiting students. So it means multiple ways of communicating to students to even let them think about participating in this thing. The communication challenges are enormous in our institutions. • Participant

Disaggregating and Disentangling

- So there are those questions of disaggregating and finding out the exact thing that you want to know, which is something that we encountered with our ADVANCE grant. People wanted to know about minority women and the *n* is too small, so some of the things that you most want to know about them you can't find out, sometimes for very good reasons. And there is also this question of disentangling what is really responsible for the effect, the multivariate kinds of analysis. • Bonne August, Facilitator

to tease out what treatment seemed to be the most effective. They had summer bridge and peer mentoring and all of those things and were able to statistically tease out which ones had the strongest effect. I thought that was a really powerful kind of thing. We all do a range of things including STEM centers. What is really working? Is it all of it or is there one thing that really matters? • Participant

There are also things like the Student Clearinghouse. There are other sources of data. That raises an interesting question of how to potentially tease out what is happening on your campus versus other STEM efforts. • Participant

Challenge: The Survey Questions You Didn't Know Enough to Ask

- There was a major challenge we had. We knew that there were problems with our laboratories and we surveyed 650 students and 60 faculty and parsed out the top five issues: more hands-on, more skills help in the lab, etc. But one of the things that we weren't able to capture was this sort of deficit in communication. One of the things that came out was that we don't communicate very well with each other. The college laboratory technicians don't communicate well with the laboratory coordinators, who aren't getting signals from the department chair, so how do we figure this out? That's not something that came up from our surveys. We didn't even know to ask that question.

  So here we are in the last year trying to figure this out. We need to focus on this challenge of communication. How do we make it better so that when a student walks into the lab, the experiment that is supposed to be set up is actually there. We've begun to address this by having a series of workshops where first we dealt with the chairs. The second workshop was bringing in the laboratory course coordinator with the chair to come up with the new college laboratory technician job description, and then come up with a laboratory course coordinator position, which many departments never had before. It is making a huge difference in bringing to everyone's attention this issue of not having equipment set up properly or not even having the equipment in the room. The next workshop will bring everybody together. Each department will bring its lab course coordinator and the department chair and we'll come up with a communication flow plan. But we didn't even know that was a problem—we didn't get that from the survey. • Participant

Supplemental Funding to Pursue Unexpected Evaluation Findings and Opportunities

- One of the challenges in terms of looking at effective practices is when you are doing evaluation and find something isn't working as

you would expect as you get further through the project. That's what NSF would like us to do, but it is sometimes hard to then reallocate funding. You could do some small allocations, but it's almost like NSF could use some innovation supplement or something so that if you find after looking at the data that the problem is not what you thought it was but something else instead, you can get a little more funding for the last two years of the grant to be able to pursue that and close the loop by trying some other innovation. We are using formative evaluation, but you don't have a way to adjust to what you discover. • Participant

Using a Logic Model to Categorize Data

- One of the things that has really helped us utilize our formative evaluation is that we are really big into logic models. It helps structure really big projects like this. Using our logic model has helped us separate out what data we need that is short-term output data. Students that are participating in this all get surveyed. Is it meeting their needs, their goals? How can we improve it? So there is that kind of output data. Then we have the longer-term outcome data, for which we use larger, broader surveys, which involve faculty and students looking at STEM culture and more institutional kinds of things. Then at the end of the logic model we look at the goals we were going for together as a whole group of STEM initiatives, not things that we can tease out that our group is solely responsible for, and use institutional data to look at things like graduation rates, underrepresented percentages, women, student major retention, all of those kinds of things. So we have had to turn to our logic model to look at what data is down in the details of what faculty thought about a particular workshop; what is the institutional, and what is the total goals and outcomes. • Participant

Building Capacity for Institutional Change into the Funding

- When we started our MSP we got training in logic models from Westat, and in fact the whole MSP was trained in a series of logic model, capacity-building set of workshops. Another value-added to these projects is the program development that comes along with being part of these projects. It is an investment in institutional capacity to change. PIs and researchers may not normally use tools of organizational management. Logic models are an equally rigorous organizing, knowledge-generating formula. It's not a research study, it's a logic model. They do the same thing, they organize your work and get you to certain ends. So to what extent are the funders building capacity for change? • Nancy Shapiro, University System of Maryland

SUMMARIZING THOUGHTS

Bonne August, Facilitator

I'm conscious of the great differences in the institutions represented here, but let's see if we can collectively agree what we want to report out. I'm going to take the liberty of saying some of the things that struck me and then ask people to add what I've left out. We looked at changing cultures in different facets of our institutions and the word "engagement" kept coming up as being the kind of cultural change that we were looking for. Some examples were to engage faulty in broadening participation, to engage community college faculty in producing majors as a way of helping them reengage in their STEM disciplines, to engage graduate students in areas outside of their discipline that would be important for them in their professional and career identities and expectations, to engage, in some cases, the whole institution in becoming a community focused in particular directions.

Processes that you or your institutions have used include community organizing and creating conversations. I thought one really important thing was the idea of having confidence that other people would value the things that your project is explicitly valuing. Another useful suggestion for processes is to tie in things that you can identify as being important to the people who are involved, such as broadening participation. They need something that says they're doing it and you can give them that, so there's a quid pro quo there.

You spoke about working bottom-up and top-down, so it's important for some things to come from administrative levels and department chairs, and some things need to come from the faculty, and those things can merge as a result of their participation in things like learning communities. I'm not sure how this fits into the overall framework, but there was also the idea of accessible systems for students, which is the middle-out idea.

Going back to community organizing, there was the idea of creating multiple points of entry for people into the activity, so if they don't come in here they can come in there and you can tie into different things that they're interested in. We had another example of engaging community college faculty in undergraduate research, tying it into things that are important to them.

We had a couple of things that addressed policy. Some of it had to do with how we use the administration and administrative support for different initiatives. Another powerful example is the idea of new degrees for creating networks for our institutions, our faculty, and our students with other institutions. It creates opportunities and pathways.

As far as the evidence of our effectiveness it

Building Capacity

The words "building capacity" came up in practically every point in our discussion and it's a really important thing if you're going to build capacity for short-term change but also for sustaining change and continuing to evolve.

What you are trying to do as an institution is build capacity for change. That is our overall goal here. • Bonne August, Facilitator

is easy to identify some significant obstacles in the institutions. One is the IRB itself. Another is the question of how we can disaggregate data that might be important in looking at particular target groups. There is also survey fatigue and communication overload with students and with faculty.

There were some interesting and helpful suggestions. I'm not sure we could do it, but there was the idea that the institution has a mechanism that would fund the development of the kind of evaluation plan that you would need, so the institution is investing in that way to help projects deal with the time frames around dealing with the IRB and other things of that kind.

There was the idea of using the proposal process to gather information on collaborations. There was the idea of using access to other sources of data that the institution might have that allow you to identify information about your students. There was the idea of designing your logic model from the beginning to include the kinds of data that you need at different points. That helps you keep identify ahead of time and keep track of what you need, what you have, and what you might have problems getting. And there was using formative evaluation.