

Meeting of the Advisory Committee for Education and Human Resources

Monday, June 12, 2017 and Tuesday, June 13, 2017

National Science Foundation, 4201 Wilson Boulevard, Arlington, VA
Stafford I, Room 1235

Meeting Goal: To provide advice regarding the National Science Foundation's (NSF) programs for education and human resource development; to advise concerning long-term strategic planning for the Directorate for Education and Human Resources (EHR).

Monday, June 12, 2017

Advisory Committee (AC) members present: Bruce Alberts, Rebecca Blank, John T. Bruer, Ángel Cabrera, Cathy Casserly, Carlos Castillo-Chavez, Muhammed Chaudhry (*virtual*), Rory A. Cooper, Okhee Lee, David H. Monk, Debra Joy Pérez, Francisco C. Rodriguez (chair), Marilyn Strutchens, Laurel Vermillion, Lilian Wu
AC members absent: Hyman Bass, Sian Beilock, Garakai Campbell, Margaret Honey, Roy Pea, James Spillane, Candace Thille

8:30AM – 8:45AM Welcoming Remarks

Dr. Francisco Rodriguez, *Chancellor, Los Angeles Community College District; Chair, EHR AC*

Dr. Rodriguez welcomed members of the AC and highlighted recent AC member accomplishments. He reminded members of EHR's three "pillars": learning and learning environments, broadening participation, and workforce development and explained that this meeting is designed to drill down on the third theme, with a focus on the **skilled technical workforce**.

8:45AM – 9:15AM EHR Investments in the STEM Workforce

Dr. Jim Lewis, *Acting Assistant Director, EHR*

Dr. Lewis welcomed the AC and began his remarks by highlighting some recent EHR events and achievements, including the January 2017 NSF INCLUDES PI meeting and the CyberCorps job fair, where 350 students were recruited by 80 government institutions. Dr. Lewis also recognized the accomplishments of some former GRFP students: 4 of NASA's new cohort of astronauts, and John Pardon, one of this year's NSF Waterman awardees.

Dr. Lewis discussed EHR's investments in STEM workforce development as context for the day's sessions. Particularly relevant to the day's discussion is the Advanced Technical Education (ATE) program which supports two-year colleges and has been around for over 20 years. Students underrepresented in STEM are overrepresented in community colleges; thus, advancing STEM education in these institutions can strongly impact broadening participation efforts. EHR's focus on the skilled technical workforce is reinforced by the National Science Board's recent interest in the same topic.

Dr. Lewis ended his remarks with comments on the Congressional direction to create a program to support HSIs and the President's proposed FY18 budget.

9:15AM – 10:15AM **Panel 1: Lifelong Learning for a Skilled Technical Workforce**

Moderator: Dr. Rebecca Blank, *Chancellor, University of Wisconsin, Madison; Member, EHR AC*

Dr. Blank introduced the panel and commented that there is growing interest in the skilled technical workforce (STW) in both academia and industry. Employment in the STW, also referred to as “middle-skilled” positions or “blue collar STEM”, requires postsecondary training but not (necessarily) a 4-year degree. The STW is a real need as interdisciplinary STEM teams in the workforce are often run by holders of bachelor’s, master’s, or PhD degrees, but may each require as many as 7-20 technicians and support personnel. A video of Panel 1 is available here: <https://www.nsf.gov/ehr/advisoryreports.jsp>

Building America’s Skilled Technical Workforce: What Works

Dr. Annette Parker, *President, South Central College; Member, NAS Committee on the Supply-Chain for Middle-Skill Jobs*

Dr. Parker was a member of the NAS committee that recently published *Building America’s Skilled Technical Workforce*. As an investigator with a 2008 NSF ATE (Advanced Technical Education) award, Dr. Parker partnered with companies in the automotive industry. Successful strategies include linking students to education and training via counseling; linking secondary and postsecondary training to make sure students are college-ready (60% of community college students are not); linking training to work via apprenticeship programs; linking skills education to employment needs.

Costs, Benefits, Skills, and Competencies for the Skilled Technical Workforce

Dr. Nicole Smith, *Chief Economist, McCourt School of Public Policy, Georgetown Univ. Center on Education and the Workforce*

Dr. Smith provided statistics about today’s students that contrast sharply with the experiences of some members of the NSF audience. Fully 75% of all enrolled students are working, with 50% of those over 30 years old working 40 hours/week. Dr. Smith stated that African American and Hispanic students too often take separate educational pathways from White students. STEM skills are valued across the workforce and some non-STEM jobs (e.g., in management) pay better than STEM jobs.

Hands-on, Minds-on: Highly Skilled Technical Workers in the American Workforce

Dr. Celeste Carter, *Program Director, ATE (Advancing Technological Education), EHR Division of Undergraduate Education*

Dr. Carter pointed out that in the US, fully 45% of undergraduates are at community colleges. Underserved minorities are over-represented on community college campuses, a fact that really deserves our attention. She argued that lifelong learning for STEM skills and background is needed, so that people have the skills and competencies to transfer to another job or geographic area if necessary. ATE was founded in response to the Scientific and Advanced Technology Act of 1992 to support workforce development, USA institutes for manufacturing, and public/private partnerships. ATE supports projects in many sectors, including automotive, nanotechnology, biomedical, space, and optics.

Panel Discussion and Q/A

AC members discussed several complex issues surrounding 2-year college enrollment, including social mobility, poverty, institutional racism, accessibility, meritocracy, and equity. AC members emphasized the importance of, but too often also *lack* of, counselors and educators who are informed and highly skilled at providing STEM career pathway guidance for all students.

10:30AM – 11:30AM

Panel 2: The Many Faces of the STEM Workforce: Broadening Participation

Moderator: Dr. Susan Brennan, *Program Director, EHR Division of Graduate Education*

Dr. Brennan opened the panel by reminding AC members that broadening participation in STEM is an EHR-wide goal. Relevant to today’s topic, EHR programs such as ATE and NSF INCLUDES aim to connect dots in novel ways so that all individuals can find their next steps in their pathway to a STEM career. A video of Panel 2 is available here: <https://www.nsf.gov/ehr/advisoryreports.jsp>

Increasing Participation of Women in the Skilled Technical Workforce

Donna Milgram, *Executive Director, National Institute for Women in Trades, Technology and Science (IWITTS)*

Dr. Milgram shared some statistics that show that women are very underrepresented in major technology career pathways, both in AS degree programs and in the workforce. She then described a recent ATE-funded program her organization developed called “WomenTech Educators Online Training”, which has led to increased female retention (and overall retention) at 15 colleges by encouraging low-cost strategies like academic support, and connecting students to role models and mentors, and to industry.

Inclusion of People with Disabilities and Veterans in the STEM Workforce

Dr. Rory A. Cooper, *Distinguished Professor and FISA/PVA Chair, Department of Rehabilitation Science and Technology, U. Pittsburgh; Member of the EHR AC*

Dr. Cooper pointed out that he was the first person to talk about disability at this meeting, but that disability needs to be an important part of the broadening participation conversation. He then outlined progress being supported by community colleges, including accepting credits for military courses, and a current ATE-funded program focused on teaching wounded veterans manufacturing skills. He argued that much work remains to be done regarding learning and working environment accommodations and policy changes.

Enhancing the College-to-Career Pathway for URM Students: The NACME Strategy

Dr. Christopher Smith, *Vice President, Scholarships, University Relations, and Research, NACME, National Action Council for Minorities in Engineering*

Dr. Smith pointed out that in 2015 only 15% of undergraduate engineering degrees were to underrepresented minorities (and only 3% to minority women). Proven best practices for broadening participation include financial support (scholarships), professional support, social support, combating stereotypes, community building (mentoring), and exposure to research – all of which require institutional commitment from the top down. His organization has developed a guide for high school students interested in obtaining an engineering degree and the steps needed to achieve that goal.

Recruiting a Diverse, Highly Skilled Technical Workforce

Dr. Francisco Rodriguez, *Chancellor, Los Angeles Community College District; Chair, EHR AC*

Dr. Rodriguez told the AC that community colleges play an important role in broadening participation in STEM and a vital role in STEM technical workforce development. He called for more research focused on the specific challenges faced by students in the 2-year system (for example, students often take significantly more than 2 years to complete a program, due to needing to start with remedial math and reading and being enrolled part-time). Dr. Rodriguez also suggested that institutions should be intentional about hiring a diverse faculty, and about providing faculty with professional development regarding how to best accommodate these diverse students.

Panel Discussion and Q/A

AC members' comments highlighted the importance of K-12 education in college readiness and reiterated the importance of the 2-year college system in preparing people for the technical workforce. AC members also emphasized the importance of partnering with industry to understand workforce needs, and with the military to ease the transition to education for veterans.

11:30AM – 11:50PM **Increasing Public Participation in and Ownership of Science: The Informal Public STEM Workforce**

Dr. Laura Trouille, *Director of Citizen Science, Adler Planetarium; Co-PI, Zooniverse*

Dr. Trouille discussed the field of Public Participation in Scientific Research, in which citizen scientists ask questions, collect and analyze data, participate in scientific discourse, and even author papers. On the Zooniverse platform, most participants are white, but within that population, the diversity of age, gender, and educational background covers a wide range. PPSR projects have both research and education goals, but it can be difficult to optimize both. After the presentation, AC members spent some time discussing links between PPSR and skilled technical workforce development. Discussion centered around what we can learn from the challenges and successes of citizen science projects in terms of engaging participants in participatory and hands-on projects as lifelong learner, and supporting STEM competency development.

12:10PM – 1:10PM **WORKING LUNCH: The View from NSF's R&RA Directorates**

NSF Directorate leadership joined AC members for lunchtime discussions, held in three separate rooms. The guiding question for the discussion was: *From the perspectives of the disciplines represented in your Directorates, what do you perceive as the most pressing workforce needs?*

Group 1, Room 1235: Dr. Margaret Cavanaugh, *Deputy Assistant Director, Directorate for Geosciences*; **Dr. Jim Ulvestad**, *Acting Assistant Director, Directorate for Mathematical & Physical Sciences*

AC members: Casserly, Cooper, Lee, Wu

EHR staff: C. Carter, C. Van Hartesveldt

Geosciences: Doing geoscience requires significant infrastructure for enabling observations on land, in the atmosphere, in space, and in the oceans. Such infrastructure includes a great deal of computer hardware for tremendous effort in modeling and major investment in ships and equipment for bringing biological information from the seafloor to the surface. Most urgent is the need to train technicians for this scientific infrastructure; technicians play a large role in data collection and deployment of equipment.

Mathematical & Physical Sciences: The need for technician training was echoed. In chemistry, the need for technicians to work in laboratories is greater than the need for more PhDs. However, typically technicians are not the ones we talk about at NSF. In the private sector related to these fields, technicians who understand data and data mining are needed in the oil industry, in wind turbine and solar energy industries, in pharmaceuticals, and in cybersecurity.

Group 2, Room 830: Dr. Fay Cook, *Assistant Director, Directorate for Social, Behavioral, & Economic Sciences*; **Dr.**

Clark Cooper, *Acting Deputy Assistant Director, Directorate for Engineering*

AC members: Bruer, Cabrera, Castillo-Chavez, Rodriguez, Strutchens

EHR staff: N. Kannankutty, L. Zia

Guests: D. Milgram, C. Smith

Social, Behavioral, & Economic Sciences: NSF's focus on *the Human-Technology Frontier* raises the question of how to foster life-long learning, especially given changes in technology, as well as what is needed for the STEM workforce at the human technology frontier. While robots have taken over certain positions, the technological revolution has created different types of new jobs. There is concern about rising inequality and how to deal with loss of jobs. SBE recognizes the importance of developing in students not only cognitive, but non-cognitive skills, including teamwork and motivation.

Engineering: One of the five ENG divisions is focused on education. The diversity of people in the educational pipeline differs depending on the engineering discipline. There is still a need to address diversity in engineering. Individuals who train in engineering at community colleges can improve their quality of life.

Group 3, Room 805: Dr. Erwin Gianchandani, *Deputy Assistant Director, Directorate for Computer & Information Science & Engineering*; **Dr. Suzi Iacono**, *Office Head, Office of Integrative Activities*; **Dr. James Olds**, *Assistant Director, Directorate for Biological Sciences*

AC members: Blank, Pérez, Vermillion

EHR staff: S. Brennan, S. James, E. Kelly

Guest: L. Trouille

Biological Sciences: The scale of life sciences is qualitatively different than it was in the 1980s. Technology has become cheaper, while the volume of data to be processed is exponentially larger. Industrial applications in biology, from agriculture to public health, have been revolutionized. How does the country scale up to take advantage of this revolution? There are not enough skilled people in the workforce.

Computer & Information Science and Engineering: Computer science is now at the core of all disciplines. This means there is a paradigm shift to *CS plus X* (where X is another discipline). These disciplines are not limited to STEM disciplines –they could be humanities, or even job sectors such as health or energy. Technology can create new jobs if accompanied by training and education; new technology also provides an opportunity to broaden participation and solve problems in this area. Outside of the 4-year college setting, we need to start to think about how technology in the workplace is changing the type of work, the work environment, and the work sector.

Office of Integrative Activities: This group has the perspective of trying to integrate disciplines and to build capacity across all states in the nation. The EPSCoR program, which includes 3 jurisdictions and 24 states that each receive less than 0.75% of NSF R&RA funds, presents an opportunity to require or encourage a focus on technological skills. Several examples were discussed, in which local people are being trained to build, operate, and maintain and monitor local infrastructure, and to develop transferable skills.

1:20PM – 4:00PM **BREAKOUT DISCUSSIONS and Synthesis: Preparing the Skilled STEM Workforce**

Conversation continued in the same rooms after lunch. The guiding questions for the discussion were: *Given what you have heard so far in this meeting, what do you think are the most pressing needs and the most high-potential opportunities for EHR (or NSF more broadly) to nourish the preparation of the STEM workforce (with special attention to the skilled STEM workforce discussed earlier)?*

Themes from the discussions were shared in a synthesis session at 3:00PM, including:

- importance of demographic data disaggregation, research impact on learning of campus- and discipline-specific climates, exploration of alternative financial models to fund education
- focus on *institutional transformation*: suggest support for integration of known best practices into a wide variety of education systems, partnerships between institutions, research on non-STEM competencies
- real-world learning experiences, stackable credentials, *soft skills are the new power skills*, personalized learning systems

4:00PM – 4:55PM **NSF Director, Dr. France Córdoba**
NSF Chief Operating Officer, Dr. Joan Ferrini-Mundy

NSF Director France Córdoba announced that Dr. Joan Ferrini-Mundy (former AD of EHR and recently Acting COO) is the now officially the permanent COO. Dr. Ferrini-Mundy was also recently awarded a Presidential Rank Award from the Obama Administration. Director Córdoba emphasized the importance of communicating to Congress the impact of the NSF STEM Education and Workforce portfolio. She asked that AC members give EHR advice about how best to communicate what has been learned through EHR investments. AC members suggested that EHR focus on collecting and curating educational resources, incentivizing reviews of education research targeted at various audiences, and including STEM *education* in STEM fairs and toolkits.

Dr. Rodriguez concluded the session by briefly summarizing the day's earlier sessions. Dr. Córdoba pointed out that the National Science Board is also interested in the skilled technical workforce.

The meeting adjourned for the day at approximately 5:00PM.

Tuesday, 13 June 2017

AC members present: Bruce Alberts, John T. Bruer, Ángel Cabrera (*virtual*), Cathy Casserly, Carlos Castillo-Chavez, Muhammed Chaudhry (*virtual*), Rory A. Cooper, Okhee Lee, David H. Monk, Debra Joy Pérez, Francisco C. Rodriguez (chair), Marilyn Strutchens, Laurel Vermillion, Lilian Wu (*virtual*)

AC members absent: Hyman Bass, Sian Beilock, Rebecca Blank, Garakai Campbell, Margaret Honey, Roy Pea, James Spillane, Candace Thille

8:30AM – 9:15AM **Welcome, Recap of Day 1, AC Recommendations to EHR**

Dr. Francisco Rodriguez, *Chancellor, Los Angeles Community College District; Chair, EHR AC*

Dr. Rodriguez announced that the next EHR AC meeting will be Nov. 30 and Dec. 1, 2017. He expressed his appreciation for the interactive format of the last couple meetings, and opened the floor for thoughts about the previous day. AC members pointed out that industry should be included in conversations about training the skilled technical workforce, and that technical skills should be incorporated into 4-year programs. AC members also discussed many complex educational and social issues involved in strengthening community college programs. EHR was urged to ensure that discussions of strengthening 2-year programs not distract from the important work of easing the path to 4-year programs.

9:15AM – 10:15AM **New Business:** Committees of Visitors (COVs) and Programs Actions in Response to 2015 COV Recommendations

Moderator: Dr. Corby Hovis, *Program Director, EHR Division of Undergraduate Education*

Robert Noyce Teacher Scholarship Program: *Dr. Sandra Richardson, Program Director*

The Noyce Program added webinars and additional panel orientation materials to clarify the meaning of NSF's merit review criteria in the context of a scholarship program. They also decreased the number of criteria to four and prepared a one-page summary of the program. They increased the participation of evaluators as panel reviewers; all panels now have at least one evaluator. They added specific language to solicitations and to webinars pertaining to high-need districts, and they added a fourth track for capacity building.

NSF Scholarships in STEM (S-STEM) Program: *Dr. Ron Buckmire, Program Director*

S-STEM provides a template for panel summaries and has participated in the NSF-wide pilot for training reviewers. They also stress the importance of constructive reviews, especially for proposals that do not receive funding. More program officers are working on the S-STEM program than in the past, and they work with other programs to do NSF Days and outreach to states that lack current funding. Finally, S-STEM increased award sizes to allow for activities beyond scholarship funding and requires projects to include standardized information about previous funding.

Human Resource Development (HRD): The HRD Division's COV last fall reviewed all six of its programs in November 2016 and those findings were discussed at the AC meeting in December 2016. After a short discussion about how to best encourage people to disclose demographic information, the AC voted unanimously to accept the HRD COV report.

Dr. Hovis asked AC members to volunteer to chair upcoming COVs for the Division of Graduate Education (late 2017) and the Division of Undergraduate Education (early 2018).

10:30AM – 11:00AM **Update on NSF INCLUDES**

Dr. William (Jim) Lewis, *Acting Assistant Director, EHR*

Dr. Lewis shared the presentation he gave the National Science Board in May 2017. NSF INCLUDES aims to bring together dedicated partners to find approaches that work to give everyone opportunities in STEM such that the STEM workforce will reflect America's demographics. Dr. Lewis reported that the first PI meeting was held in January for the first 40 launch pilots. He encouraged everyone to visit <http://includes2017.videohall.com/presentations> to see the videos prepared by each funded project. In addition to funding a second round of launch pilots, NSF is exploring mechanisms to provide opportunities for projects already in the NSF broadening participation portfolio to join the NSF INCLUDES National Network (watch for a Dear Colleague Letter coming soon). NSF was encouraged to ensure that industry, HSIs, Asian-Pacific Islander students, and a focus on physical disability are included in NSF INCLUDES initiatives. Dr. Lewis's slides are available here: <https://www.nsf.gov/ehr/Materials/INCLUDESSlides.pdf>

12:30PM – 2:00PM **Open Learning Resources: Subcommittee Status Report and Discussion**

Dr. Catherine Casserly, *Strategist, Learning, Openness, and Innovation; Member of the EHR AC*; **Dr. Lee Zia**, *Deputy Division Director, EHR Division of Undergraduate Education*; **Meredith Jacob**, *Creative Commons/USA*; **Kristina Peters**, *New America*; **Joseph South**, *IDEO; Former Director, Office of Educational Technology, US Dept of Education*

A video of this session is available here: <https://www.nsf.gov/ehr/advisoryreports.jsp>

Dr. Zia briefly outlined the topics discussed by the subcommittee since its creation, including resource quality, incentives, and stakeholders. Meredith Jacobs of Creative Commons USA presented legal background about open licensing. Ms. Jacobs explained that copyright attaches by default to any educational materials that are released, which can restrict use. Because open licensing communicates to the public that a resource is free and allows flexibility in implementation, others are allowed to “Retain, Reuse, Revise, Remix, and Redistribute”. In response to questions, Ms. Jacob discussed the choice to allow unique contributions by additional authors to be copyrighted (or not), the ability to “brand” openly licensed materials, and the right to remove attribution from revised resources.

Kristina Peters and Joseph South both worked until recently on the #GoOpen movement at the US Department of Education, which supports districts and states using open resources in their classrooms. They have developed a “district launch packet” based on the experiences of 18 districts, and regional summits have been attended by over 1000 people from 180 districts nationwide. Research questions include policy implications of removing text book purchases from district budgets, and what works (and doesn't) in different environments. The Department of Education requires that curricular resources they fund be open licensed.

Two additional guests, Doug Levin from EdTech Strategies and Nicole Allen from SPARC, took part in the conversation that followed. Some AC members expressed concern that open licensing would remove a profit-motive for creation of educational resources. Department of Education guests responded that fewer than 5% of their grantees currently commercialize their products. Moreover, innovators can commercialize resources developed outside of federal funding, and commercial businesses retain the opportunity to offer “value-added” training and professional development based on OER. Other AC members wondered if open licensing might decrease learning disparities between districts; this is an open area of research in K-12 and in higher education. AC members worried about quality control for openly licensed resources. There was broad agreement that quality control *and* access are essential.

The meeting adjourned at approximately 2:15PM.