Best Practices in Education and Diversity at NSF Science and Technology Centers

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Overview. This white paper is a collaborative effort by the education and diversity directors of National Science Foundation Science and Technology Centers (STC) to share best practices among ourselves (so we can learn from each other) as well as with new education and diversity directors (so they can hit the ground running). This project has its genesis in the annual STC directors' meetings. The incredible richness of experience and expertise shared at the 2013 and previous meetings led us to create an online survey to systematically collect qualitative data from our colleagues. After pre-testing the questions with selected Centers, we invited all 14 active STCs (Appendix 1) to complete the 24-question survey (Appendix 2). Ten centers (71%) responded. We coded the raw data and identified key themes, which were then synthesized into the best practices below. This paper was presented at the February 2014 STC education and diversity directors' workshop as a living document, and future contributions are encouraged.

Note: This list of best practices is intended as a guide, not a checklist. Different centers have different strengths and needs, and may be governed by different cooperative agreements. Some suggestions and practices from one Center may not necessarily transfer to another.

Best Practices

Integrating diversity, education and research can be challenging, but is a critical measure of an STC's success. Base your education programs around your Center's research, and involve both researchers and educators in program development and delivery. Expose all Center personnel to education and diversity activities and allow them to creatively contribute. If your STC doesn't require all personnel to participate in broader impact activities, incentivize their participation. Provide training and "dry runs" to ensure success.

Use a vertical approach to integrate diversity, education and research at the strategic plan level. Keep diversity in mind when hiring faculty and graduate students. Think beyond numbers: diversity should encompass equity, access, and inclusiveness. Try to recognize implicit biases. Ask yourself questions like: "How often do I collaborate with faculty at minority-serving

institutions?" and "Are students reading papers from researchers of diverse backgrounds?" Truly integrating diversity into our centers may require a cultural change, such as accepting different ways of being so everyone can contribute and be successful.

Developing and delivering Center-wide education and diversity programs. Designate staff, programs and resources at each partner institution. Build programs around local strengths and partners; it's not necessary to replicate all programs at all institutions. Consider offering multi-site programs, such as undergraduate research experiences.

Communication and team-building. Engage in frequent virtual communication to exchange information, share successes and stimulate collaborations. Create an online directory with each person's photograph, role and biography. Invite all participants to an annual meeting, and include a graduate student retreat and social activities. Rotate meeting locations to fully engage partners. Host more frequent local or regional meetings as appropriate. Provide funding for personnel exchanges among institutions; students and post-docs can serve as effective "bridges" between investigators.

Promoting leadership among graduate students and post-docs is integral to the STC mission. Create a student/post-doc council to plan events such as journal clubs and educational outreach. Provide professional development training opportunities based on student/post-doc input and feedback. Incentivize their participation by linking to an evaluation or rewards structure. Include students and post-docs on key management committees and develop mechanisms for them to propose their ideas. Communicate their successes to a broad audience.

Evaluating your education and diversity programs is essential in identifying challenges and documenting successes. Hire external evaluators, and work closely with them. Build evaluation into program design, not as an afterthought. Think about how the data can be used as a way to drive methods and approaches to evaluation. Focus both on short-term outcomes and long-term impacts, and use a variety of qualitative and quantitative instruments. Utilize national statistics to evaluate your success and ensure metrics are specific to your Center's disciplines. Publish your results in peer-reviewed journals.

Developing and maintaining partnerships for education and diversity can be useful to gain advice, leverage resources, and maximize results. Find partners with common interests and goals, and invest in them. Establish win-win partnerships; recognize that both sides of the partnership have to benefit. Nurture long-term partnerships by maintaining regular communication. Move strategically and don't stretch yourself too thin.

Working as part of your STC leadership team. Actively engage in Center leadership. Serve on your Executive Committee and provide input on budget, personnel, and management decisions. Create an education/diversity advisory council. Recommend experts in education and diversity to serve on your External Advisory Board. Encourage your Center's leadership team and faculty to participate in education and diversity efforts; their buy-in is essential. Develop respect and trust. Start small but think big. Be patient.

Funding & Sustainability. During the first five years, focus on developing excellent programs and documenting success, not fund-raising. Work with your Center director to establish an annual budget for education and diversity. Begin your sustainability plan at the renewal process, to use time and institutional leverage effectively. Institutionalize your most important programs by working with University leaders and building relevant partnerships. Be selective about what programs to sustain; accept that you can't keep them all. Explore all potential funding sources, including federal, state, and local government, the private sector and user fees.

Annual reports and site visits require careful management and advance planning. First, establish clear criteria to determine who qualifies as Center participants and set up a system for collecting data on education and diversity at least quarterly. Maintain working documents and update them throughout the year. Tie reporting requirements to funding to ensure timely compliance. Designate one person to collect data and issue writing assignments. Include an executive summary to showcase your key accomplishments. For site visits, conduct a dress rehearsal and review presentations for content and flow.

An effective online presence requires a dedicated, full-time professional. Ensure your website is accessible, device and mobile friendly, and well-organized. Include information for both the general public (e.g., your mission, recent activities, and accomplishments) and Center participants (e.g., calendars, documents, and data sharing). Implement security measures as appropriate. Strike a balance between keeping your website informative, without making it too onerous to keep up-to-date. Use a variety of social media for a variety of purposes. For example, Facebook allows current and former participants to stay connected and engaged, while a Twitter feed can share Center activities on a daily basis.

By ***collaborating with other Centers***, we can maximize the value-added impact of the STC network as a whole. Invite education and diversity directors of other STC's to serve on your advisory boards. Identify areas of affinity and creatively collaborate (e.g., jointly offer undergraduate research programs or graduate/post-doc professional development). If your STC develops a new tool or program with wide applicability, consider sharing it. Plan to attend professional conferences together to co-convene sessions, co-author presentations, share exhibit booths and recruit students – e.g., the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) national meeting is well-attended by STCs across disciplines.

Conclusions. Although new education and diversity directors will need to go through the learning process themselves, we offer these best practices as guideposts to refer to along the way. We encourage new directors to reflect upon these best practices, discuss them with their STC leadership team, and remember that they don't have to do everything at once! Although the job can be daunting, the rewards are enormous.

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Appendix 1. Active Science and Technology Centers and their Education and Diversity Leadership

(http://www.nsf.gov/od/iia/programs/stc/active_centers/ACTIVE.jsp)

BEACON Center for the Study of Evolution in Action (BEACON)
 Judi Brown Clarke, Diversity Director
 Louise Mead, Education Director

Biology with X-Ray Free Electron Lasers (BioXFEL)
 Margarita L. Dubocovich, Education & Diversity Director
 Anthony Hutchinson, Education & Diversity Coordinator

Center for Brains, Minds & Machines (CBMM)
 Ellen Hildreth, Co-Coordinator for Education
 Haym Hirsh, Co-Coordinator for Education
 Mandana Sassanfar, Diversity Coordinator

Center for Coastal Margin Observation & Prediction (CMOP)
 Vanessa Green, Director of Student Development and Diversity
 Nievita Bueno Watts, Director of Academic Programs

Center for Dark Energy Biosphere Investigations (C- DEBI)
 Cynthia Joseph, Diversity Director
 Stephanie Schroeder, Education Director

Center for Energy Efficient Electronics Science (E^{3}S)
 Sharnnia Artis, Education & Outreach Director
 Lea Marlor, Education and Outreach Program Manager

Center for Integrated Quantum Materials (CIQM)
 Tina Brower-Thomas, Education Director
 Kathryn Hollar, Education Director

Center for Layered Polymeric Systems (CLiPS)
 Pamela Bligh-Glover, Executive Director for Planning & Education
 Tryreno Sowell, Director for Education & Diversity
 Risa Hartman, Director for Education & Diversity

Center for Microbial Oceanography: Research and Education (C-MORE)
 Barbara Bruno, Education Director

Center for Multiscale Modeling of Atmospheric Processes (CMMAP)
 Scott Denning, Director for Education and Diversity
 Melissa Burt, Education and Diversity Manager

Center for Remote Sensing of Ice Sheets (CReSIS)
 Linda Hayden, Associate Director of Education
 Darryl Monteau, Education Coordinator
 Cheri Hamilton, K-12 Education Outreach Coordinator

Center for Science of Information (CSoI)
 Brent Ladd, Director of Education
 Kelly Andronicos, Director of Diversity

Emergent Behaviors of Integrated Cellular Systems (EBICS)
 Linda Griffith, Director of Education
 Manu Platt, Director of Diversity
 Leslie McClain, Education and Diversity Program Manager

Team for Research in Ubiquitous Secure Technology (TRUST)
 Aimée Tabor, Education Director
 William Robinson, Outreach Director

Appendix 2. Survey instrument

Introduction

This survey is designed to gather best practices in STC education and diversity from the people who run the programs: you. Many of us were thrown into our jobs with little training or preparation, and learned things by trial and error. The purpose of gathering best practices is to share them among ourselves (so we can learn from each other) as well as with new education and diversity directors (so they can hit the ground running).

I am hoping that each Center will take the time to provide thoughtful responses. This may take 2 hours or more. **For centers that have more than one director/manager for education and diversity, please work together and submit a single survey (one survey per center).**

There are 24 questions. All questions are optional. Please feel free to skip any questions that don't apply, or that you don't wish to answer. Regarding anonymity, we will separate the identifying information from the responses. I am asking for your identifying information so we can acknowledge all contributors, track which centers responded, and clarify responses as needed. But if you prefer to respond anonymously, please feel free to do so.

If you have any questions or concerns, please contact Barbara Bruno, C-MORE Education Director, barb@hawaii.edu

Section 1. General information

1. Name of STC. (Only one survey per STC, please).

2. Name(s) and title(s) of everyone who helped complete this survey. (All contributors will be acknowledged.)

3. Email address(es) of all contributors

4. My center offers programs and/or resources for: (Please check all that apply)
    - General public
    - Elementary school students
    - Middle/intermediate school students
    - High school students
    - Community College students
    - Undergraduate students at 4-year colleges/universities
    - Graduate students
    - Post-doctoral researchers
    - Informal science educators
    - Teachers of K-12 students
    - Community college faculty
    - University faculty

Section 2. What advice/best practices can you share about.........

5. Determining "who counts" as being part of your Center? (Is it determined by funding?)

6. Promoting communication and team-building within your center (across multiple institutions)?

7. Developing or delivering Center-wide education and diversity programs and resources (across multiple institutions)?

8. Engaging Center students and researchers in education and diversity efforts (across multiple institutions)?

9. Promoting leadership among your graduate students and post-docs?

10. Obtaining funds to support your education and diversity programs while your STC is active (Years 1-10)?

11. Sustaining your education and diversity programs beyond Year 10?

12. Evaluating your education and diversity programs?

13. Integrating diversity, education and research?

14. Developing and maintaining partnerships for education and diversity?

15. Creating/maintaining a STC website?

16. Use of social media?

17. Preparing for site visits and annual reports?

18. Working as part of your STC leadership team (within your center)?

19. Working with other STCs?

20. Which conferences to attend? Why?

21. Anything not covered above?

Section 3. Key take-home messages

22. What are the two most important pieces of advice that you would give a new STC education director? (Feel free to repeat things stated above.)

23. What are the two most important pieces of advice that you would give a new STC diversity director? (Feel free to repeat things stated above)

24. Any other comments?