Biology
Research Experiences for Undergraduates

Principal Investigators Workshop

March 30 – April 1, 2017

Bio REU Leadership Committee

2017

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Executive Summary

A workshop for principal investigators of Research Experience for Undergraduates (REU) Sites funded by the Biological Sciences Directorate at the National Science Foundation was held on March 30 - April 1, 2017 at the Holiday Inn Rosslyn in Arlington, Virginia. The workshop was held to bring principal investigators together to network, share best practices and to provide the Leadership Committee with feedback to inform the development of recommendations to funders about how the program might be improved. The workshop theme was “Enhancing and Strengthening the REU Experience Through Program Evaluation and Effective Communication.”

In attendance at the 2017 workshop were 124 representatives from REU site grants, several representatives from the National Science Foundation, including Dr. James Olds, Assistant Director for the Directorate for Biological Sciences (BIO), and three plenary speakers. Activities included networking meals, a poster session, a presentation by NSF program officers, two plenary talks on evaluating REU programs and one plenary talk on science communication, plenary follow-up breakout discussions, and several breakout discussions focused on issues of interest to REU Site Directors. This report includes detailed summaries of the presentations and discussions held at the workshop.

Based upon the feedback from PIs received during the workshop, the Leadership Committee has identified some general areas, presented here as recommendations, where investment could potentially improve the impact and effectiveness of REU Site programs. These recommendations provide guidance for all stakeholders, including but not limited to the Leadership Committee, interested in identifying actionable items to improve the nation’s capacity to support STEM training through undergraduate research opportunities.

Recommendations

1. Adoption of the new platform for a common assessment tool is one of the top priorities of the REU community. The existing platform has a series of operational problems, including an interface that is not easy to use, difficulties in obtaining information, and an inability to modify the tool. Consequently we would like to see a clearly defined pathway for adoption of the new platform for the common assessment tool.
    a. Identify what additional requirements NSF has for demonstrating functionality.
    b. Pilot test the new platform for the common assessment tool in summer 2017 with REU site programs.
    c. Analyze the feedback provided by PIs on the common assessment tool and develop a plan for revision of the tool.

2. There was considerable concern that Mathematica has not communicated with PI’s about REU applications and tracking. We note that this was a recommendation from the Pan REU meeting and there seems to have been no acknowledgement or awareness of this recommendation. We understand the need for legal compliance for longitudinal tracking of students. This could be accomplished by requiring all sites to collect minimal

information concerning applications, with that information either pushed or pulled from the site-specific application forms. While many PI's would benefit from having access to a common application tool, requiring a common application tool could be highly disruptive for many programs. Consequently, we recommend a minimal approach to satisfying tracking requirements that does not require use of additional services.

The Leadership Committee

The Bio REU Leadership Committee (LC) was established following the 2007 Bio REU PI workshop. Its mission is to promote an active and diverse undergraduate Biology research program. The LC plans and hosts the Bio REU PI workshops; compiles and disseminates "best practices" and resources for REU program development and implementation (e.g., common assessment tool, responsible conduct of research resources, mentor training resources); compiles and disseminates data about REU students; and develops and maintains a website with information for current and prospective REU Site directors (www.Bioreu.org).

Leadership Committee members:

John Barthell	University of Central Oklahoma
Ian Billick	Rocky Mountain Biological Research Station
Janet Branchaw	University of Wisconsin - Madison
Susan Carson	North Carolina State University
Carmen Domingo	San Francisco State University
John Matsui	University of California – Berkeley
Camellia Okpodu	Norfolk State University
Julio Soto	San Jose State University
Michelle Evans White	University of Arkansas

Bio REU PI Workshop History

The 2017 workshop was the sixth workshop held for Bio REU PIs. The first was a combined REU and UMEB PI meeting, which was held September 24-26, 2003 at the National Science Foundation (NSF) and hosted 140 participants and practitioners. The second, held in March 2007 hosted 133 Bio REU PIs and 10 speakers and was also held at NSF. As a result of the March 2007, the Bio REU Leadership Committee was established and has assumed responsibility for planning and hosting the PI workshops since. In 2010 the LC hosted a workshop for 149 REU program representatives and 10 speakers that focused on the America COMPETES Act (Responsible Conduct of Research and Assessment). In 2012, the workshop hosted 128 REU program representatives, several speakers, who were also PIs, and focused on assessment, strategies for enhancing and sustaining REU programs and training in the responsible conduct of research. In 2014, the workshop hosted 145 REU program representatives, several representatives from the National Science Foundation and four plenary speakers. Activities focused on using evidence-based approaches to enhance and strengthen the REU experience.

2017 Workshop Overview

Workshop Goals

All workshop participants had the opportunity to:

- network with REU colleagues;
- share effective strategies that they use in their own programs and learn from others;
- learn about effective program evaluation practices and science communication strategies;
- provide the Leadership Committee with feedback on the REU program and make suggestions for ways to improve it

New PIs had the opportunity to:

- become oriented to the relationship between REU site programs, the NSF, and the Leadership Committee;
- learn about REU program "best practices;"
- ask questions and meet experienced colleagues to whom they can turn for guidance and advice as they launch their programs

Workshop Activities

Networking Meals - Workshop participants met one another and shared experiences and best practices around common interests.

Poster Session - Workshop participants presented posters (Appendix 3) highlighting the best features of their REU programs to share best practices and models.

Plenary Talks - Speakers shared their expertise in program evaluation, alumni tracking, and science communication.

Plenary Breakout Discussions - In the first plenary breakout session, workshop participants reviewed the questions on the Common BIO REU Assessment survey tool and provided feedback on whether data from each should be aggregated across programs. In the second plenary breakout session, workshop participants used discussion questions provided by the plenary speaker to explore various venues and mechanisms to communicate about their REU site programs to different audiences.

Breakout Sessions - These were facilitated discussions on topics identified by PIs in a pre-workshop survey. Experienced PIs were invited shared their expertise and best practices. Workshop participants volunteered to take notes at the breakout sessions. In addition to capturing the main points of the discussion, they recorded feedback and recommendations for the LC generated by the group.

2017 Workshop Notes and Summaries

DAY 1

Poster Session

The poster session sparked conversations between workshops participants, which included sharing of best practices such as effective means for engaging student in research, evaluating program successes, and assessing student learning. Twenty-one posters were received and displayed on first day of the workshop, then remained on display through the second day of the workshop in the main meeting room at the hotel.

The focus of the poster session was to highlight unique elements of broad interest to PIs of other REU sites. Presenters were asked to highlight what their program does well including, but not limited to:

1. Unique educational aspects, such as training of students to become future faculty, professional ethics, research skills etc., and how your program succeeds in meeting this goal.
2. Approaches to broadening participation - recruitment of underrepresented groups, recruitment from institutions with limited research opportunities, including two-year colleges.
3. Assessment/program evaluation and long-term tracking strategies.
4. Outcomes, publications, patents
5. Other topics, such as general information, research focus, program structure, were welcomed.

Full abstracts of the posters that were presented are in Appendix 3.

DAY 2

Welcome: Dr. James Olds, Assistant Director for the Directorate for Biological Sciences

Dr. Olds focused on the importance of REU programs to recruiting American citizens to research early in their academic careers and for training the next generation of scientists. He applauded BIO REU efforts to recruit diverse trainees and to establish common metrics and measurement tools for assessment and evaluation that will allow us to tell an aggregate story of

success. He encouraged REU programs to focus on preparing students for research careers in biology and to build their computational skills in preparation for the future.

Plenary 1a: Dr. Christine Pribbenow, LEAD Center Director, Wisconsin Center for Education Research

"Student Assessment and Evaluation of Undergraduate Research Experiences: The Who, The What, and The Why"

Dr. Pribbenow presented an introduction to program evaluation and defined how it is different from educational research. The presentation included a description of what one needs to do program evaluation (evaluation questions, a logic model and an evaluation plan) and four levels of evaluation (reaction (satisfaction), learning, application, impact).

Plenary 1b: Dr. Cecilia Speroni, Senior Researcher, Mathematica Policy Research

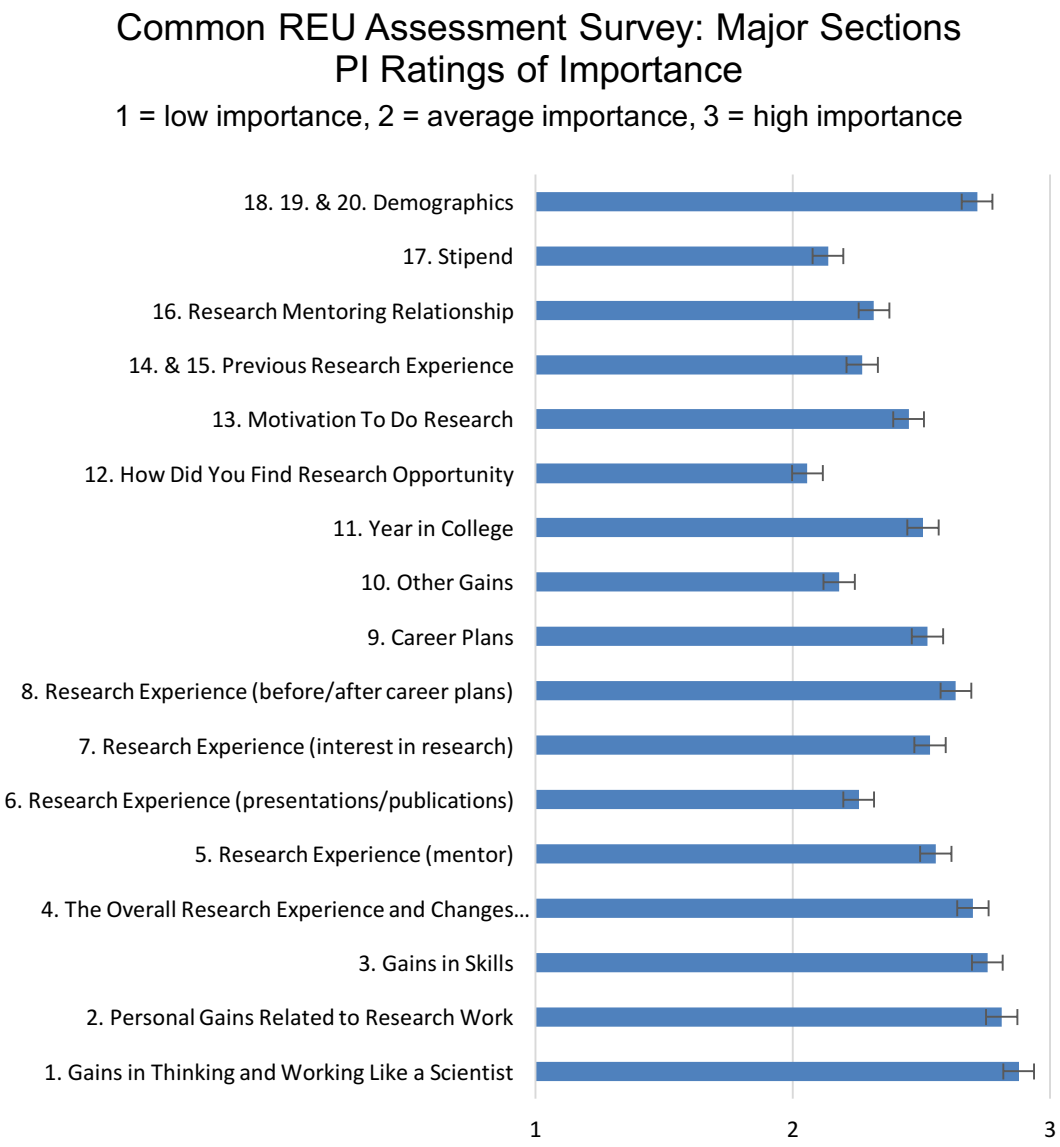
"Developing an Evaluation Framework and Pilot Testing an Electronic Data System"

Dr. Speroni described a pilot project to develop an REU tracking system that Mathematica had been contracted by NSF to do. The America Competes Reauthorization Act of 2010 requires that REU students be tracked for at least 3 years after graduation from college. Previously, a feasibility study was done (Zuckerman *et. al.*, 2016) that showed a new data collection system would be needed. Mathematica is considering developing a common REU application portal and they aspire to develop an evaluation framework. A subset of REU programs will be participating in the pilot project, which will track outcomes of past participants to establish status quo benchmarks.

Plenary 1 Break Out Sessions

These homogenous breakout sessions aligned with the Plenary talks on evaluation given by Drs. Christine Pribbenow and Cecilia Speroni. In each session, PIs reviewed the BIO REU Common Assessment Tool and provided feedback on the scales and questions.

Overall, 89 PIs completed an online survey in which they reported they would like the BIO REU Common Assessment Tool survey to be approximately 21% shorter. In addition, they rated the importance of each of the major survey sections as shown below.



Biology REU Site Updates & Overview: Drs. Sally O'Connor and Amanda Simcox, NSF Program Directors

Dr. O'Connor presented some BIO REU updates and tips for grant renewals. Dr. Simcox presented information about submitting annual and final reports.

Data about the Bio REU applicants and participants:

- BIO has been over 50% underrepresented minority students since 2011
- 100% of programs participated in the common assessment

Tips for REU renewals:

- Identify a cohesive theme for the program
- Provide detailed demographics both of participants and applicant pools from prior support
- List presentations/publications
- Mention awards received by participants (GRFP, etc)
- Longitudinal tracking information
- Funding - request a maximum of 10 students for a maximum of 10 weeks - 90% of direct costs should go to participant costs

Annual and final reports:

- Report on activities and participants from prior year ONLY (not cumulative)
- PIs will receive a request for an early report in order to enter students. Do this while students are still on campus, then re-submit at a later date with additional information.
- Common assessment tool results must be included as pdf in the “special requirements” section

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Plenary 2: Dr. Ian Billick, Executive Director, Rocky Mountain Biological Laboratory

“Communicating Science and Science Training”

Dr. Billick overviewed his personal experiences with communications, noting that many of the site directors are already doing wonderful things with communications. He started as Executive Director of the Rocky Mountain Biological Laboratory (RMBL) in 2000. At the time as a nonprofit RMBL was struggling financially. RMBL started adding people with corporate experience to the governing board, which had historically been comprised solely of scientists. Adding those individuals forced RMBL to think deeply about communications.

Billick then reviewed two examples of RMBL thrown in the communication spotlight. First, in 2009 one of their NSF-funded projects was identified as one of the top 100 stimulus pork projects. He was interviewed for the Hannity Show. While the interview was highly scripted, with no opportunity for exchange of ideas, he indicated that the experience helped RMBL realize that they need to communicate why field research can lead to insights that make the larger world a better place. That insight assisted with fundraising and also created rich intellectual opportunities within ecology and evolutionary biology.

He then showed the video, The Snow Guardian, by Morgan Heim with Days Edge Productions. Centered on billy barr (not capitalized), it showed his life of measuring snow and what he is learning about a changing climate. With over 3 million views in the last 6 months, he noted that the strong narrative, as much as the science, was critical to it going viral. He also emphasized the importance of making it easy for media to develop pieces.

Moving on from the examples, Billick then talked about the rich body of research emerging about how the brain works and what that tells us about communications. He noted that communications and the exchange of information is often not about understanding, but rather about identity and justifying pre-existing beliefs and biases. He also noted that our brain works in lots of different ways. For example, emotion is critical to making decisions. People without emotion cannot make decisions and those with limited ability to use emotion, make poor decisions.

He closed with a series of suggestions for people to think about, including identifying desired outcomes when communication, aligning your goals with the goals of the audience, the importance of managing identity when communicating, the role of communicating to the public to improving science, and the importance of conveying passion and emotion.

Plenary 2 Break Out Sessions

These heterogeneous breakout sessions aligned with the Plenary talk given by Dr. Ian Billick: *Communicating Science and Science Training*. Each session emphasized communications through different mechanisms and to core target groups. They included and were facilitated by: communicating with elected officials (Sue Carson), communicating through social media (Camellia Okpodu), communicating through traditional media (Ian Billick), communicating with parents and families (Carmen Domingo), communicating with an institution in terms of operating an REU program (Michelle Evans-White), aligning an REU program within institutional goals (John Barthell), and cross-cultural communications and diversity (John Matsui). Recorders and reporters were designated for these sessions and their information forms the basis for the summaries provided, below.

Communicating with Elected Officials

Participants brainstormed the primary goals of communicating with elected officials, as well as strategies to accomplish these goals. The group agreed that we should have defined goals for each communication and that the strategies employed should be the ones most likely to achieve those goals to minimize burnout of faculty/scientists, as well as ensuring that elected officials will not feel that their time was wasted.

The most significant reasons to communicate with elected officials voiced were to retain/increase funding for science at the national and local levels; to communicate the value of science; to advocate for expanding diversity of students involved in REU programs and broadening participation in STEM, in general; and where appropriate, to influence specific legislation.

Some strategies in which participants are currently engaged are using existing structures for lobbying, such as participating in Posters on the Hill both statewide and nationally; inviting elected officials or staff members to university events, such as undergraduate research

symposia; recognizing the representative by inviting him/her to speak at the event; and working through the lobbying groups of professional organizations.

Some general communication tips that arose were as follow:

- Understand motivations. Explicitly articulate how your idea will benefit his/her constituents often and early in the conversation.
- Be mindful of your dual role as both a university employee and a private citizen. Contact officials on your own behalf using your private contact information. Go through your organization for official requests.
- Value staffers in a representative's office. They can have influence.
- Be specific in requests and communicate the clear outcomes you're seeking.
- Prepare brief, impactful talking points - you will have limited time.
- Personal anecdotes draw politicians in. Support your stories with data when possible.

Communicating Through Social Media

No notes from this discussion were submitted for the report.

General Communications

While this group was initially assigned to discuss traditional media, it discussed communications broadly. Ideas that emerged including providing students the template for an NIH letter of recommendation (F31 and F32 forms), surveying students in advance of the program to help them identify their personal goals, establishing a contract between faculty and students, integrating communications into ethics training, and working with development offices. One program described a general program they do on advocacy.

Communicating with Parents and Families

Why communicate with parents?

1. To support the career choices of the REU students.
2. To advocate for science and REU programs and potentially to NSF about the importance of the REU program with regards to the impact the program had on their child's training

How to communicate with parents?

There was consensus that the communication with parents and families should be through the REU student. It could also be done non-intrusively from REU programs.

The REU PIs should discuss/explain to the students the source of funding for the REU program so that they understand how the politics and funding are involved in supporting REU programs.

When possible, invite parents and family members to attend end of summer research symposia. For those that are located to far to attend the symposium, the meeting can be streamed to parents (with permission from faculty and students). This provides an opportunity for the families to understand the impact of the REU experience on their child and to experience the enthusiasm and excitement of scientific research.

Provide opportunities for REU students to learn how to communicate their research activities effectively to the public, which includes their family members. Importantly, encourage them to do this and explain the importance of actively communicating about their activities to members of their community. This will allow for a ripple effect that could help the public better appreciate the scientific process.

Communicating within an Institution in Terms of Operating an REU Program

Many programs had a final research presentation symposium and invited college or university administrators and faculty. A small number invited politicians. Programs suggested that administrators and faculty outside of the programs were always impressed with the sense of community and closeness between the mentors and student; some invited family members and program alumni to this presentation as well. Several more established programs gained institutional support by communicating how programs could facilitate increased diversity in under-represented groups applying for graduate school within the institution and a few had administrators provide additional funds to support student needs not traditionally covered by NSF (e.g., childcare expenses). Some programs highlighted the importance of the program for local communities and were able to gain additional financial support from local non-profit groups. A few of the younger programs expressed having difficulties successfully communicating with mentors the long-term research potential of 10-week student participants. Some expressed difficulty negotiating long-term commitments with institutions given changing administrations. Additional tools programs use to communicate with their institutions include videos of students saying thank you and the naming of scholarships/fellowships after donors. Several program managers used some of the quantitative data they collected for NSF reports to communicate the importance of their program to their institution. The endeavor to develop a common REU tracking tool would aid this effort. REU program directors had several development suggestions for the NSF and Bio REU LC. A website link to a packet/flyer of some commonly-used tips that people have used to leverage support from their institution would be helpful. A statement that clarifies the importance of institutional support would allow the collective to be more effective communicating.

Aligning an REU Program within Institutional Goals

Becky Ostertag served as the session recorder and Andrea Kramer as the reporter. Some of the major challenges experienced by PIs in this area of communication include intra-institutional considerations such as how to pay students (especially those not native to the PI institution), form of payment (stipends, salary, etc. with implications for federal and state regulations), and inter-divisional and departmental units within colleges. Solutions to these challenges may include how students are registered with the students (as temporary students with IDs, etc.) and enhancing communication between collaborating units on a university campus (e.g., the Division of Finance with the Division of Academic Affairs). The current funding mechanism at NSF might also include consideration of different university types and their respective needs. Some campuses need more access to PI funding during the summers (even if in small amounts) in order to ensure that sufficient senior personnel are available to work with students on (sometimes) relatively short notice. The other side of the argument is that this revenue (both

direct and indirect cost revenue) is new to the university and allows it to do more towards its mission, especially if that mission is student-centered.

Some recommendations were also provided as to how the NSF might also assist faculty members with grants to create better intra-institutional alignment. These include developing a letter that would go to the chairperson, dean, and provost of an institution that has just received an REU grant, congratulating the faculty member for receiving the grant or, at least, copying the same individuals during award notification. In addition, assistance in creating NSF-based marketing materials that can be tailored to individual programs was suggested. Issues related to individual institutions (as described above) were noted with the desire to have more flexibility in revenue use, especially with regard to underrepresented groups, included consideration of the following: child care, food and stipend costs, and allowing students to return for a second REU experience at the same Site. It was also suggested that more materials to provide guidance on best practices (e.g., guide books or special journal volumes) would help PIs.

Cross-Cultural Communications and Diversity

What are the major challenges in this area for PIs?

- Gaining experience in and practicing cultural awareness
- Making sure mentors are also culturally aware
- Creating safe spaces for students to disclose challenging mentoring/program situations

What solutions/strategies currently exist to address these challenges?

- Cultural competence- rigid, stereotypical understanding of a culture that may not account for individual differences
- Cultural humility-constructive process that calls upon the individual to construct understanding through realistic and ongoing assessment, learning, and self-appraisal
- Empathy- we can't really know what it is to be like in another's shoes instead we should think about the Third Space Approach that generates real-time information about each other
- Lots of discussion about using language like this: "I have read about culture X and how individuals from this background would generally respond when faced with a situation like this. Would you say this is true for you?"
    - Some people felt very uncomfortable making these broad generalizations as it felt like stereotyping people and an awkward way to get into the discussion
    - Others felt that if the scope of the question was smaller, it would be a good way to indicate that you want to learn more about the individual's experience

Why are you interested?

- Sense of belonging
- Inclusion
- URM
- Privilege
- Equity
- Language barriers
- Freddie Gray
- Retention

- Changing the status quo
- Confidence and self-esteem
- Family
- Funding

DAY 3

Breakout Sessions

Participants were surveyed before the workshop to gauge their interest in breakout discussion topics. Based on survey responses, participants were assigned to three different breakout sessions discussing a total of seven topics, with most topics discussed by two or three groups. Prompts were developed for each topic, and facilitators from the leadership committee led the sessions. A volunteer was recruited in each group to take notes and the facilitator consolidated those notes to generate the report summary. All workshop participants reconvened after the breakout sessions, where note takers reported the main points from their sessions.

Common REU Program Resources

Awareness of available common resources varied across the participant group. Most program directors knew about and used the common assessment tool (URSSA) and the student travel awards; a few spoke about how wonderful the mentor-student travel fellowships were and expressed the desire to have that program continue to receive funding. Program directors mentioned that the following common resources were helpful: travel awards, mentoring training, ethics training, supplements, assessment, list of REU programs and contacts on the NSF website, PI meetings, GRFP workshops. Many REU site directors did not know about the BioREU website (bioreu.org) and the resources available there. Several mentioned how useful this PI workshop was and how much it has helped them address and overcome challenges with program administration over the years. Program directors had some challenges with website's that have common resources being out of date and were unsure of who the appropriate contact was to request updated information. Meeting participants wanted to see NSF or the LC develop a common application template that would be available to help new programs get started with their program. Many program directors spoke about how unwieldy the process can be and how much of their own time and resources have been spent over the years fine-tuning their application practices; even then the application process can produce anxiety about security because of the sensitive information that might be provided. They felt like a common template and resource area would help others avoid some of the pain associated with "reinventing the wheel". Many participants thought that a website where common resources could be shared easily and quickly across REUs would make their lives more efficient. A Wiki page format might be a possibility. Additionally, a document describing more specifically the requirements for a good annual REU NSF report distributed annually and/or at the time of funding would be incredibly helpful and may help streamline the work for NSF program officers as well as fewer

PIs would be learning by trial and error. Finally, there was an interest in NSF or the LC providing an appropriate categorization of STEM fields so that student tracking information can be appropriately categorized in reports.

Establishing an International Component to your REU Program

Key points from the discussion:

A. One approach is to request a supplemental on an active REU site award to "pilot" an international program prior to submitting a full international REU proposal
B. Student recruitment and selection is key to international REU program success especially in developing countries
C. An international REU can be structured in a variety of ways but the key is to submit a proposal (to panel) that demonstrates that students will be safe and productive.
D. Enlisting committed international partners is key to the success of an international Res program
E. International REU may be leveraged to secure a NSF IRES or RCN award that builds on projects established under the international REU
F. Reviewers are likely to be more hesitant with proposals that simply send students abroad without actual engagement in travel by the PI or CoPI.
G. Knowledge of and planning for changes in political climate or socio-economic challenges in the host country are imperative
H. International REUs require a heavy workload for PIs in planning logistics as well as the actual projects to be undertaken
I. Securing sampling permits and, in some cases, government authorization to do research in the host country must be planned out in advance
J. A pre-travel bootcamp or at least series of video conferences is an effective way to prepare REU participants for international travel
K. If possible, providing students with a partial stipend disbursement prior to travel is important especially if serving students from low-income households.
L. A central theme that necessitates the work to be done in the foreign country is advisable since the cultural exchange component is important but, ultimately, the science has to be solid.

Culturally Responsive Mentoring

No notes from this discussion were submitted for the report.

Pre- and Post-REU Program Enrichment

Main Points of the Discussion:

A. Challenges focused mostly on post activities. A primary concern was the desire to send more than one student from their REU program to a conference to present their research. The PI’s understood that REU students can apply for travel awards, but this does not always allow them to attend. This is particularly important for low income

students that have not other way of attending a conference. In addition, conference attendance is also a positive outcome for the REU mentor.

B. Give the distance, it can be a barrier for figuring out how to keep a student engaged in their research project. Funds to bring students back to their labs is limited and not typically supported by the NSF REU program. For those working in dry labs (computational projects) working remoting is feasible.
C. During the academic year, students are busy and distracted with their academic coursework so finding the time to continue with research projects may be challenging.
D. With regards to pre-activities some of the challenges were focused on how much material is appropriate to send to the REU student ahead of the program. Some felt that it empowered the student to come better prepared for their research projects. Others felt that it puts unnecessary pressure on the student while they are busy trying to finish up their classes.

Pre-Program Enrichment Activities:

- mentors provide journal article before summer (and sometimes a review)
- have students develop an “action plan” (Individual Development Plan) at the end of the program (how can their mentor help to support their 1-year career goals; students say where they need help; mentor has to sign off on the plan); can be a pre-activity (before they show up, collect) or a post activity (refine the plan); can model it after AAAS resource (http://myidp.sciencecareers.org) ****
- some have mentors contact students, while others have students contact mentors
- mentors communicate before program (up to them in many cases)
- mentors set up group chat before they arrive (skype, zoom)
- improv based activities before (to get to know one another)
- students given a choice of mentors so they read up on the different labs and projects
- set up facebook page in advance (good before and after)
- provide roommate info before they arrive
- have students prepare a set of questions that they are going to ask their mentors the first day
- current students take them out to dinner before program start (and some do a tour of the city that is fun)
- one comment was that students need to focus on their course work and achieving good grades in the spring rather than doing anything related to the program. Some suggested sending some material, but not too much that may overwhelm the student.
- invite faculty from small college and let them pick & bring a student from their institution; this builds longer term relationships and allow post interactions
- retreat and networking activity for recruiting (field station example); helped with recruiting
- set up a wiki with general questions about personalities, which is then used for matching, and they get to know one another
- Develop a proposal and revisit it over the summer
- Set up private facebook group
- Provide detailed information packet
- Set up mentoring and ambassador committees that consist of REU students

- Provide a contract to students that outline expectations of the program as well as their respective roles and responsibilities.
- Safety and assessments of where they are at scientifically (through pre REU survey)
- Share outcomes of prior REU experiences and products (show them list of papers). Show that some students come back for years.
- Set up facebook pages
- Created unique modules that will be taken by REU students before arriving to get them ready for their research training experience

Post-Program Enrichment Activities:

- attend lab meetings if near by
- keep in contact with the students
- sending them to meetings (and having them meet up at SACNAS, or others); some get funding from their own institution
- manuscript preparation after require communication
- computational can engage through activities in subsequent year, e.g., NSF cyber system used to continue project
- annual newsletter to keep up with students
- ask students to identify a mentor at their home institution; can work in helping them make the transition
- Mini symposium
- Conference attendance - very impactful experience that allows for post-mentor training with the REU student. Also important for the tenure review of faculty mentors.
- Write supplements to bring students back a second year. (sometimes they are received well but sometimes they are not). Alumni can be real mentors to new students.
- Have REU students organize a symposium at their home institution and maybe if there are multiple REU students at the institution NSF funds could sponsor that event
- group writing project (science communication) that students work on before they leave and then the PIs work on getting it published afterwards with input from the REU students in the fall.
- many mentors were alum of the REU program. Diversity of the students is there but the diversity of the mentors is not there. So having alumni as mentors is very powerful.
- Help REU students to put together a GRFP NSF application. Give overview of the program and then follow up with assistance for any student that is willing to write the proposal.

Evaluation of REU Student Learning

Three consecutive break-out sessions were facilitated by Dr. Sue Carson on the topic of Evaluation of REU Student Learning.

Challenge: The BIO REU common assessment tool provides valuable feedback on the student experience and how the student perceives his/her own gains in skill. However, it does not directly evaluate student skills or gains. Whether a research experience gave rise to useful data

is also not necessarily reflective of student skill. Developing scientists *require feedback* on what they do well and areas for growth. Mentors would benefit from a *framework* in which to offer constructive feedback.

Each break-out began with a discussion of the different goals we have when doing assessment/evaluation. The “common assessment tool” that we use is to inform us about how we might improve our individual programs and how that aggregate data helps Sally advocate for BIO REU funding. Another reason to do assessment or evaluation is for the purpose of formative feedback to students in order to help them develop during and after their REU experience. In this break-out session, we focused on how to provide students with supportive critical feedback on their higher-order thinking skills.

The facilitator shared two examples of frameworks with rubrics for providing feedback on students’ higher-order thinking. The first, the NC State TH!NK rubric (https://think.dasa.ncsu.edu/wp-content/uploads/sites/20/2015/09/Common-Rubric-2015-for-website.pdf) focused on a framework for specific skills and behaviors in the critical and creative thinking process. The second, created by K. Spoehr for the Brown University Teagle Project Collegium, (https://www.brown.edu/about/administration/sheridan-center/sites/brown.edu.about.administration.sheridan-center/files/uploads/SampleUGResearchProjectRubric.pdf) focuse on specific outcomes of engagement in research.

Discussion of strengths and limitations of each of the two rubrics and other methods for providing students constructive feedback, including an individual development plan ensued. One limitation of every direct measure of higher-order thinking that we discussed, is that because the REU is so short, and the skills need to be demonstrated over time, it is not possible to do a pre/post score showing gains. Therefore, it is not completely useful for programmatic assessment. However, that does not mean that we should not still articulate to students what the critical and creative thinking process should look like at the highest levels, and provide feedback on their strengths and areas for future growth.

Recommendations to the LC: The majority of participants voiced that they did *not* think a rubric common to all REU programs would be appropriate. However, the majority did express that *every program should have and be able to articulate a plan for how participants will receive constructive feedback on higher-order thinking*, whether it be through the use of a rubric or other means.

Best and Cost-Effective Practices in REU Program Administration

Two sessions were conducted on this topic with one reporter, David Weiss, and two recorders, Joff Silberg and Lihua Wang. There were areas in common among the sessions and they are reported together here. Tracking of students was a common theme and concern was apparent among PIs (some have literally hundreds or more students) trying to keep track of their past participants through time. This creates a time constraint on PIs with larger and older programs. (Some have even employed people to regularly keep track of former participants to ensure that

an accurate evaluation of the students can be made during renewal requests.) Ways to approach student stipend payments were also raised as being a difficulty at some institutions in terms of meeting differing fiduciary responsibilities among universities and other Site institutions. Another discussion raised the question of what kinds of student participant activities qualify as professional development during grant-funded research. A distinction was made between cultural and historical opportunities (paid by students through their own means) and field trips and visiting scholars who link directly to project outcomes of the grant.

Best Practices in Implementing Ethics Training

Drs. John Pijanowski & Michelle Whaley led a discussion that focused on identifying challenges, strategies and solutions, and making recommendations to the leadership committee. They introduced the subject by describing that ethics training is geared towards a process of setting up norms of behavior, helping people develop strategies for dealing with ethical decisions, helping them confront the gap between judgement and action, and provide a toolset for critically reviewing decisions and actions.

Techniques for training can include asking students to reflect on personal experiences, identifying barriers to doing the right thing, connect personal ethical dilemmas to their work as scientists, and developing a plan for overcoming barriers to ethical action.

The group discussed the numerous legal frameworks within which scientists must work, including institutional review boards, noting that those legal frameworks vary between countries. There was also recognition that normative behavior can vary even between laboratories within the same institution.

Pijanowski and Whaley indicated that the major factors causing a gap between judgement and action are poorly understood, rarely taught, and are largely where ethical failures occur. Addressing the judgment action gap is a process involving developing critical self-reflection as a personal and professional development tool.

Appendix 1: Workshop Agenda

NSF BIO REU PI Workshop, March 30-April 1, 2017

Holiday Inn Rosslyn, Arlington, VA

Day 1

1:00 – 5:00 PM	Registration and Name Badge Pickup
4:30 – 5:00 PM	Poster Session Set up
5:00 – 6:15 PM	Poster Session
6:15 – 6:30 PM	Welcome & Meeting Goals *Janet Branchaw, LC Chairperson*
7:00 – 8:45 PM	Networking Dinner

Day 2

7:30 – 8:30 AM	Continental Breakfast & Informal Poster Session
8:30 – 8:45 AM	Welcome & Meeting Goals *Janet Branchaw, LC Chairperson*
8:45 – 9:15 AM	Welcome and Remarks *Dr. James Olds, Assistant Director for the Directorate for Biological Sciences of the National Science Foundation*
9:15 – 10:30 AM	Plenary 1 A) "Student Assessment and Evaluation of Undergraduate Research Experiences: The Who, The What, and The Why" *Christine Pribbenow, PhD,* *LEAD Center Director, Wisconsin Center for Education Research,* *http://lead.wceruw.org* B) "Developing an Evaluation Framework and Pilot Testing an Electronic Data System" *Cecilia Speroni, PhD,* *Senior Researcher, Mathematica Policy Research* www.mathematica-mpr.com
10:30 – 10:45 PM	AM Break
10:45 – 12:00 PM	Plenary Talk Breakout Discussion 1 (see postings for assignments) • Review the current version of the common assessment tool questions • Provide feedback on scales & questions
12:00 – 12:30 PM	Plenary 1 Discussion Report Out
12:30 -- 12:45 PM	Biology REU Site Updates and Overview *Dr. Sally O'Connor and Dr. Amanda Simcox,* *Program Directors at National Science Foundation*
12:45 – 1:30 PM	Networking Lunch and Informal Poster Session

1:30 –2:30 PM	Plenary 2: Communicating Science and Science Training, *Ian Billick, PhD,* *Executive Director, Rocky Mountain Biological Laboratory.* *www.rmbl.org*
3:45 – 4:00 PM	PM Break- Light Snacks, Beverages, and Networking
4:00 – 4:30 PM	Plenary Talk Breakout Discussion 2 (see postings for room assignments) • Discuss the plenary talk and how to incorporate what was presented into REU programs
4:30 – 5:00 PM	Breakout 2 Reporting & Announcements
5:00 PM	Adjourn for the Day

Day 3

7:30 – 8:30 AM	Continental Breakfast and Poster Take Down
8:30 – 9:15 AM	Breakout Session of Choice *1.* Common REU Program Resources *2.* Establishing an International Component to your REU Program *3.* Culturally Responsive Mentoring *4.* Pre- and Post-REU Program Enrichment *5.* Evaluation of REU Student Learning
9:15 – 10:00 AM	Breakout Session of Choice *1.* Common REU Program Resources *2.* Best and Cost-Effective Practices in REU Program Administration *3.* Culturally Responsive Mentoring *4.* Pre- and Post-REU Program Enrichment *5.* Evaluation of REU Student Learning
10:00 – 10:15 AM	AM BREAK – Beverages and Light Snack
10:15 – 11:00 AM	Breakout Session of Choice *1.* Common REU Program Resources *2.* Best and Cost-Effective Practices in REU Program Administration *3.* Culturally Responsive Mentoring *4.* Best Practices in Implementing Ethics Training *5.* Evaluation of REU Student Learning
11:00-11:45	Breakout Session Report
11:45 – 12:00 PM	Meeting Adjourned

Appendix 2: Workshop Attendees

Institution Name	First Name	Last Name	Email Address
Marquette University	Allison	Abbott	allison.abbott@marquette.edu
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Appendix 3: Poster Presentations

1. Insights from alumni about distinctive features of the Cary Institute's 28+ year REU program, Alan R. Berkowitz, Aude Lochet, Shannon LaDeau, Stuart Findlay, Felicia Keesing, *Cary Institute of Ecosystem Studies* (NSF Award Number:1559769)

2. Promoting inclusion in STEM fields through REU programs: An evaluation of common program assessment technique, Andrew L. McDevitt, Manisha V. Patel, Aaron M. Ellison. *Harvard University,* Harvard Forest Summer Research Program in Ecology (NSF Award Number:1459519)

3. Engaging REUs through citizen science and global change ecology, Alison Cawood and John Parker, *Smithsonian Environmental Research Center,* Global Change Ecology at the Smithsonian Environmental Research Center (NSF Award Number:1659668)

4. The successes and challenges of a multi-institution REU site, Amy Jo Stavnezer and Jennifer R. Yates, *College of Wooster and Ohio Wesleyan University,* Collaborative Research: REU Site: A Distributed Network of Neuroscience Scholars (NSF Award Number:1560061)

5. Making your science matter: Science communication training in a changing landscape, Carol Sotka, M.A. and Robert Podolsky, Ph.D., *College of Charleston,* Research Experiences in Marine Organism Health: Resilience and Response to Environmental Change (NSF Award Number:1359079)

6. Increasing diversity in environmental studies and evolutionary developmental biology, Carmen Domingo and Sarah Cohen, *San Francisco State University,* Research in Environmental Studies and Evolutionary Developmental Biology (NSF Award Number:1156452)

7. Cloud-based computing education for the next-generation of computational biologists. Conant, G. C., Shyu, C.-R., Becchi, M., Pires, J. C., Mekus, Z., Okerstrom, K., Shearer, C., Wright, A., Rosental, J., and Nielsen, B., *University of Missouri- Columbia,* Educating for the grand challenges at the intersection of biocomplexity and high-performance computing. (NSF Award Number:1358997)

8. The Rice University biological networks summer program: Enhancing recruiting from community colleges with limited research opportunities, Jonathan J. Silberg and George N. Bennett, Rice University, Interdisciplinary Program in Multi-Scale Biological Networks (NSF Award Number:1560097)

9. Well to wheels approach to sustainable biobased products and energy development REU, Kakani, VG; Atiyeh, HK; Bellmer, D; Dunford, NT; Fathepure, B; Frazier, SR; Huhnke,

RL; Jones, C.; Kumar, A; Mahalingam, R; Sunkar, R; Will, R; and Wu, Y., *Oklahoma State University,* Interdisciplinary Approach to Sustainable (NSF Award Number:1262514)

10. REU site: Using the Lake Erie sensor network to study land-lake ecological linkages, Kevin Czajkowski, Carol Stepien, and Jeanine Refsnider-Streby, *University of Toledo,* Undergraduate Research and Mentoring - Using the Lake Erie Sensor Network to Study Land-Lake Ecological Linkages (NSF Award Number 1461124)

11. New REU Site at Kettering University: Utilizing plants for innovative research (UPIR)-cultivating the next generation of scientists and engineers, Lihua Wang, James Cohen, Veronica. Moorman, Michelle Ammerman, and Cheryl Samaniego, *Kettering University,* Utilizing Plants for Innovative Research (UPIR)-Cultivating the next generation scientists and engineers. (NSF Award Number:1560169)

12. Hawaii REU “Ohana”: Increasing recruitment through relationship building and partnerships, Ostertag, R.; Puniwai, N.; Ching, M.; Ziegler-Chong, S.; Heu, L.; Miller R.; and DeJesus, J., *University of Hawaii at Hilo*, Conservation Science in Hawaiian Ecosystems (NSF Award Number: 1461301)

13. Research experience in systems biology and OMICS tools, Ramesh Katam and Virginia A Gottschalk, *Florida A&M University*, Undergraduate Research Experience in Genomics, Proteomics and Bioinformatics (NSF Award Number: 1560049)

14. REU site in molecular biosciences at Colorado State University, Fort Collins, Paul J. Laybourn, *Colorado State University,* REU Site in Molecular Biosciences (NSF Award Number: 1460507)

15. Recruiting, mentoring, and evaluating for BIO REU site program at University of Oregon, Peter M. O'Day and Marilyn Drennan, *University of Oregon,* Program in Molecular Biosciences at the University of Oregon (NSF Award Number: 1460735)

16. Rural & tribal undergraduates (REU) and high school students (Pre-REU boot camp): Recruiting efforts and outcomes, Van A. Doze, Bethany Davis, Donald A. Sens, Peter Meberg, Rebecca Simmons, and Karen Cisek, *University of North Dakota*, Genes & the Environment: Research experiences for undergraduates from rural & tribal colleges (NSF Award Number: 1359243)

17. Instituting a writing program at the Ohio State University Molecular Biology REU Site to promote student engagement and success, Susan E. Cole and Jane E. Jackman, *Ohio State University*, Research opportunities in molecular biology at Ohio State University (NSF Award Number: 1560163)

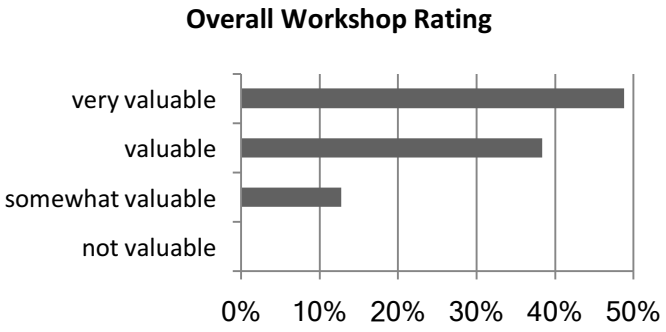
18. A Developmental Approach to the REU Application Process, Michelle Whaley*, University of Notre Dame*, Integrative Cellular and Molecular Biology (NSF Award Number: 1659556)

19. Comparative Approaches in Cellular, Molecular and Environmental Biology, Sandra Rieger, Ph.D., Paulyn Cartwright, Ph.D., Robert Morris, Ph.D., and Jane Disney, Ph.D., *Mount Desert Island Biological Laboratory*, Comparative Approaches in Cellular, Molecular and Environmental Biology (NSF Award Number:1460495)

20. The Future of Natural Gas: A Millennial Perspective by NSF REU Scholars from the Bioenergy Systems REU at the University of Nebraska-Lincoln, Samuel McCarthy and Paul Blum, *University of Nebraska-Lincoln*, Integrated Development of Bioenergy Systems (NSF Award Number: 1560163)

Appendix 4: Workshop Evaluation Results

1. Overall, how would you rate the 2017 BIO REU PI Workshop?



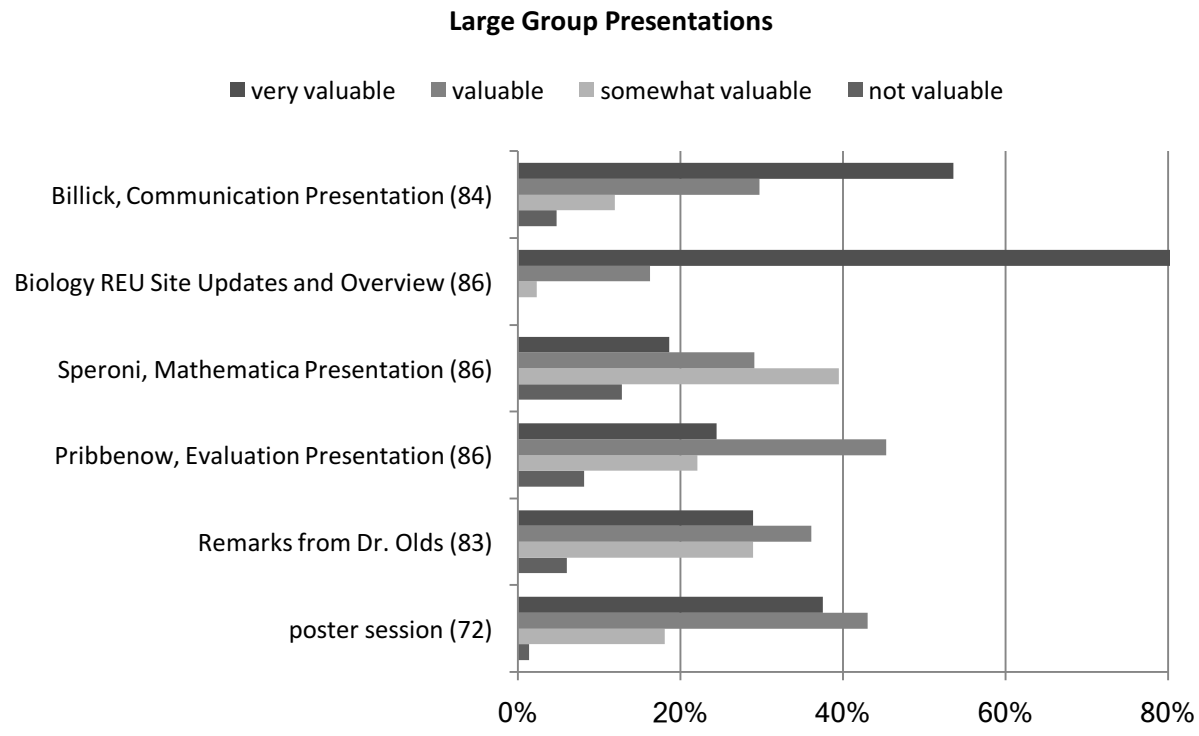
2. What was the most valuable thing about this workshop for you?

- Meeting, chatting with other PI, posters, some of the workshops
- tracking & best practices
- break-out sessions
- Networking with others
- breakout session on ethics on Saturday morning; plenary talk 2
- ability to share ideas and strategies with other REU PIs.
- Networking
- The breakout session of choice - all three that I attended (Carson's, Matsui's and Whaley/Pijanowski's
- interaction with other PIs and sharing ideas on how to best use the program to serve the undergrad students
- Learning helpful hints from PIs who have done this work for a longer time than me
- hearing about practices in other programs
- Science communication
- Connections and one on one discussions
- Meeting people and discussing recruiting ideas and program activity ideas
- Networking
- Several practice-changing ideas
- Learning from the experience of others: tips, suggestions, networking.
- Networking
- Learning about the priorities for NSF and the REU, ethics, evaluation
- Break-out sessions and the ideas that were shared were very useful
- learning what other REU programs were doing
- hearing how other PIs have administered their programs and learning about resources I did not realize were available
- Presentation by and discussion with NSF program directors
- new ideas
- informal conversations with other REU PIs
- Networking with long-time AND new colleagues, learning about NSF's current view of REU, planning for specific aspects of program (assessment, ethics, cultural responsiveness, etc.)
- Learn the way in which other REUs are run was the best part of the workshop.
- International Research experience, Cultural assembly
- Networking with other PIs and learning how what we are working on can benefit other programs
- discussing practices with other directors
- Matsui's sessions and networking
- Hearing ideas and best practices I can implement in my own REU program.
- Interacting with other PIs; Sally O´Connor's talk; the work sessions
- The small break out groups

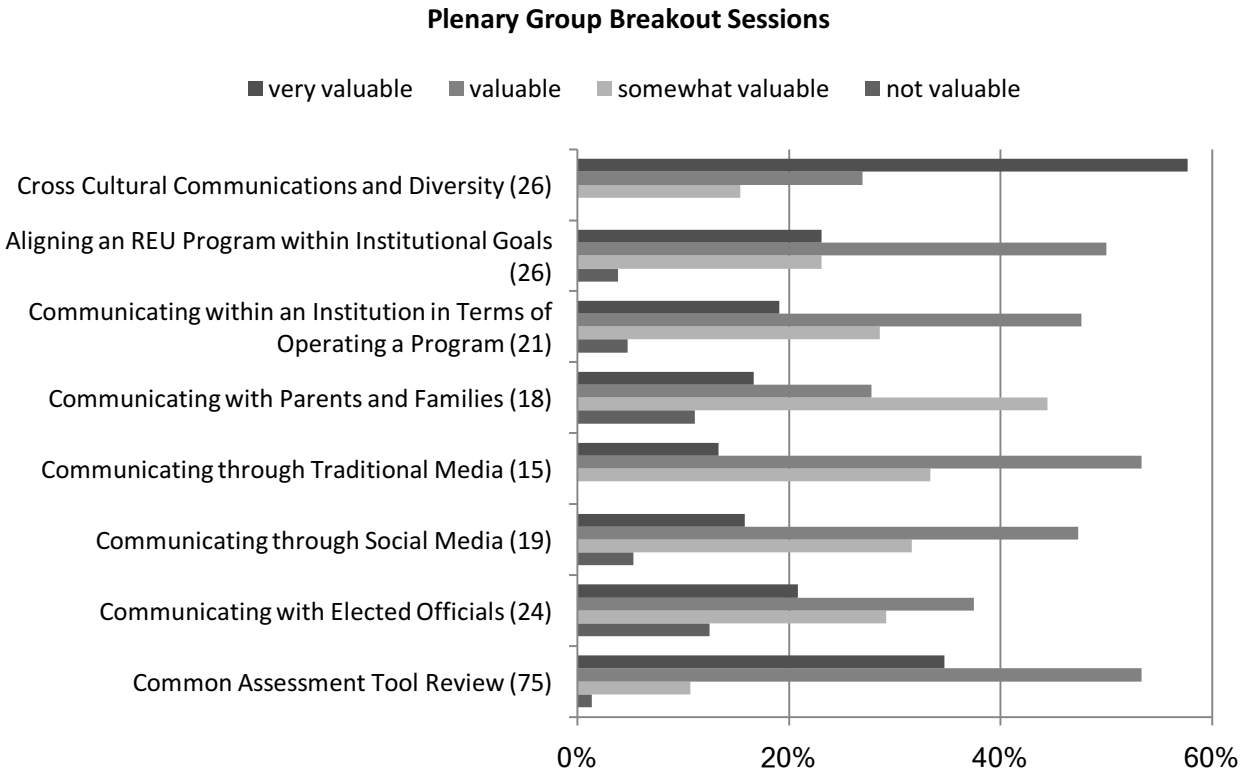
- Interacting with others who run REUs and the practical workshops on ethics and cultural sensitivity.
- learning some of the differences between International REU and IRES programs
- meeting other PIs
- As a new PI learning how to submit renewals and benchmark progress of students across years
- Networking with experienced PI's
- networking with other PIs and gaining new insights for how to run a successful REU
- Sally's comments, meeting other PIs
- Learning about assessment tools
- Simply connecting with other PIs to share experiences and ideas.
- The networking and discussions with the other PIs.
- Interacting with other PIs and hearing from the NSF POs
- It's always valuable and energizing to be around others that are so passionate about encouraging undergraduate research.
- Plenaries and related discussions
- The opportunity to learn from other PIs.
- networking and learn what others are doing
- Sharing strategies and resources, getting ideas, learning more about the history and details
- Gaining knowledge about NSF's plans for future REU program proposal submissions and networking with other PI's to learn about how they implement REU programs.
- Understanding what resources were available to PIs
- networking with other PIs to learn about other practices with their REU programs
- Hearing about what other programs do and troubleshooting challenges together.
- As a first-time attendee, the breakout sessions on the last day were particularly informative
- Talking with experienced REU directors
- Sharing tips with other PIs
- Being able to talk with other REU sites about best practices
- Concurrent sessions about cultural diversity, international REU
- The diversity discussions
- Networking with other REU PIs
- Getting ideas from others
- As a co-PI for a new REU program that will start this summer, I learned so much at the workshop, from tips on how to run the program to specific information that we need to keep track of. Thank you so much for all that the LC has done!
- New ideas from colleagues
- Suggestions I pick up from participants about how to improve my own program
- Sharing of best practices during the breakout sessions
- learning about what other programs are doing
- networking and breakouts on managing REU funds/best practices
- comments about renewal proposals
- Talking with other PIs
- The too short breakout sessions on the last day
- information about grant submission, networking
- Sue Carson rubrics, John Pijanowski ethics, Ian's session
- New idea for refining my REU program, e.g., including an individual development plan
- Getting tips and tricks from other REU PIs
- Meeting other REU PIs; many new ideas for our REU program
- Meeting people with histories of successful REUs
- Networking
- Learning what others are doing.
- How incredibly much work I will be required to do in addition to training students in the arts of research.
- gleaning strategies from posters and talking to other PIs
- the talk by the head of RBML

3. To what extent do you think the workshop goals were achieved?

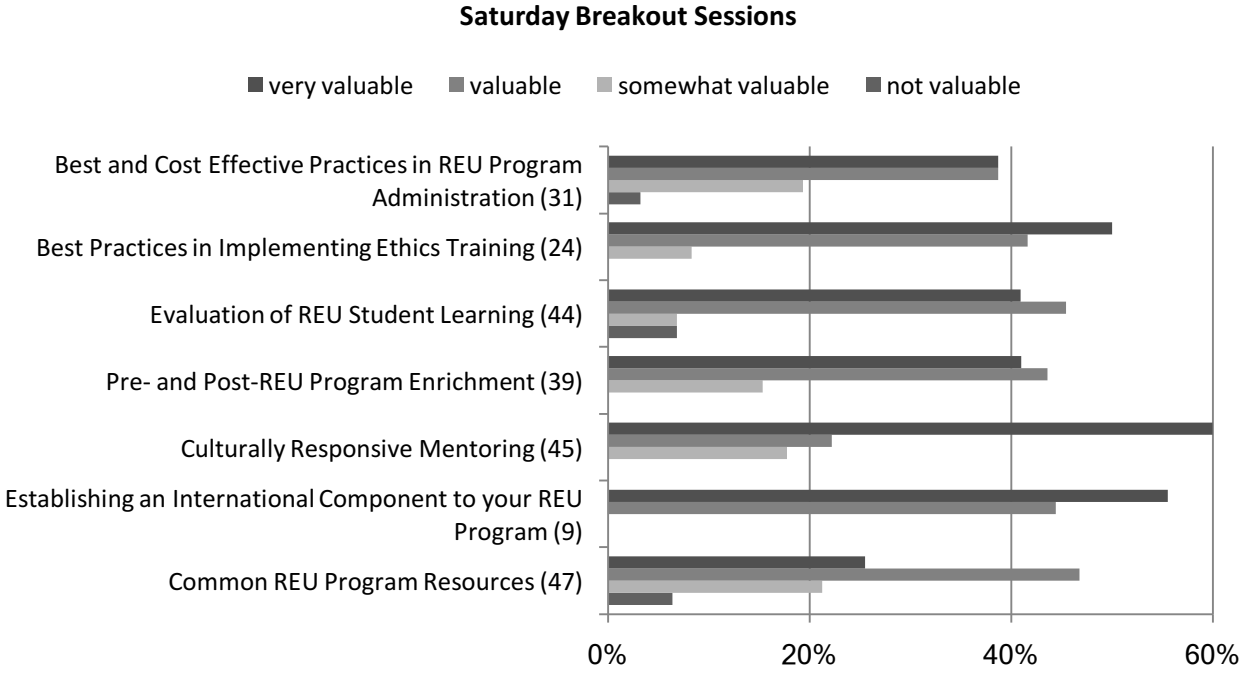
4. Please rate the value of each large group meeting component.



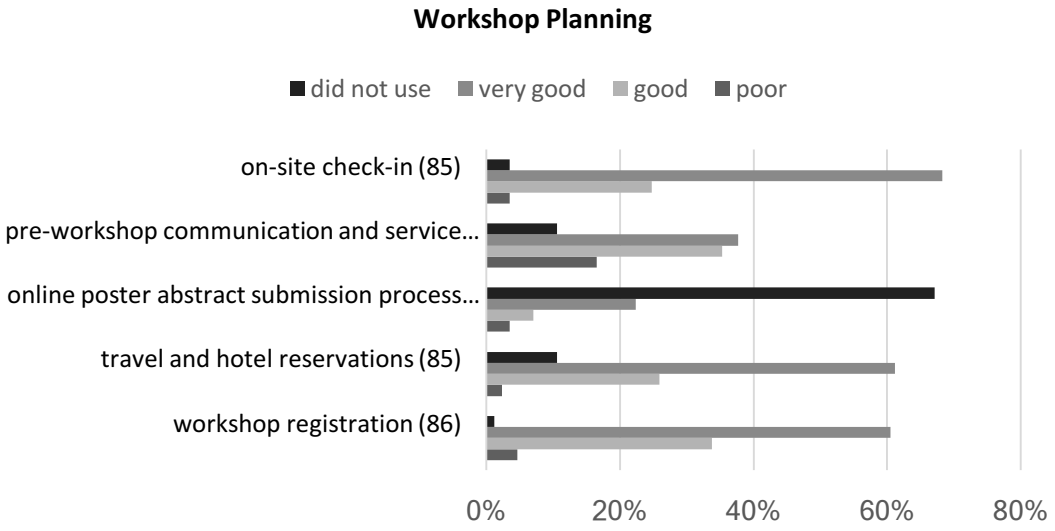
5. Please rate the value of each Plenary breakout group meeting that you attended.



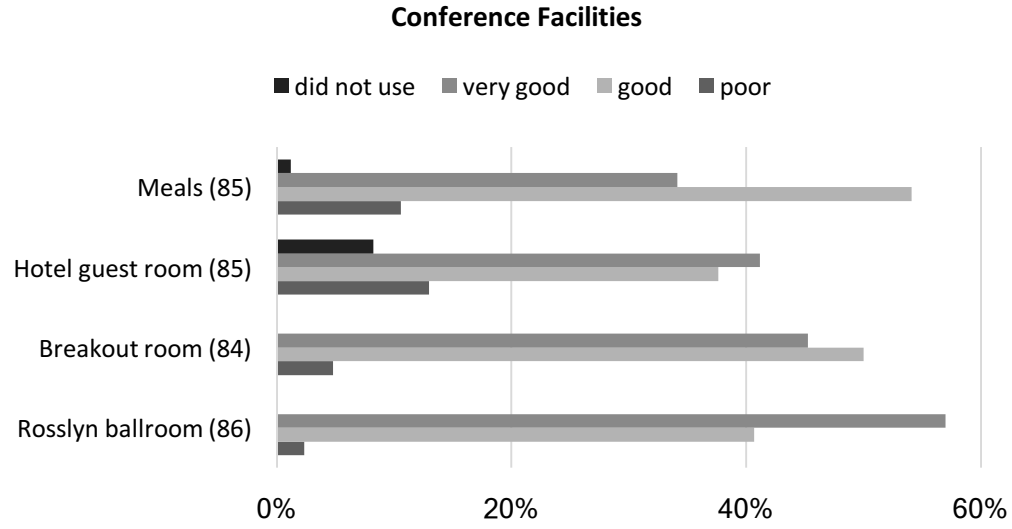
6. Please rate the value of each Saturday breakout group meeting that you attended.



7. Please rate these aspects of the workshop planning.



8. Please rate the conference facilities.



9. What suggestions do you have to improve future PI workshops?

- Please change the hotel for workshop- rooms were bad beds were creeking and overall very noisy
- More time to discuss strategies that are working and not working for REU sites.
- Keep doing what you did, including a meeting during the Cherry Blossom season.
- More and earlier communication with PIs about the conference
- I think it might be useful to have reading on specific topics before the meetings.
- Fewer talks from invited speakers. More opportunities to talk to nsf.
- Presentations from Directors to discuss their individual programs--strengths and challenges. I could imagine one session with six or so 10-15 minute talks, more productive breakout/workshop groups. Work could be done before the meeting (filling out the survey

about the assessment tool), then groups could be given more meaningful work to do at the meeting. The breakout time was not very productive.

- more sustainable food options for lunch; better technology in breakout rooms (presenters could not use power points)
- Larger room for poster session
- Given that a large number of people were brand new, the absence of real information as to the purpose or agenda of the meeting was bizarre. I think that those who have attended many likely just knew it was a free flow thing but there was NO communication about what would be happening, no knowledge that I should bring my laptop to sessions, no idea what the purpose or substance would be. We are really busy people taking on an extra responsibility, more forward communication is needed. As well, little things like "saving paper" by creating a giant mess as people have to search for what break out they've been assigned to, just seemed to create needless chaos. Just a few improvements will make this a much more useful and efficient meeting.
- Water in breakout rooms. It would be great to use a larger font for the last name and institution on the name tags.
- More time to discuss ideas with other PIs. I thought that more information was going to be conveyed in the workshops. In some of them it felt like the blind leading the blind because we didn't know have answers.
- Stick with this meeting model - it was great!
- Better communication of the agenda a week or so ahead of the meeting. I also think more sharing of articles and readings through shared mini-review or mini syllabi could help with implementation. For example, cultural sensitivity could be implemented through a series of readings that could be assigned or used as background for discussions with REU participant students. Such literature resources could be an important take-home from the meeting and could also be archived on the web site.
- I think that another interaction activity on the evening of the first day of the workshop would be valuable. the poster session was really good for interacting with different PIs, but there wasn´t enough time. So a second chance would be appreciated.
- Better communication before it starts
- More notice! I didn't know whether my poster abstract had been accepted until Monday the week of the conference, so I didn't have much time to pull things together
- Please do not ask us to arrive at Noon, which requires heroically early flights, unless there is something for the afternoon. By the time we saw the schedule, it was too late to rebook flights. A Thurs afternoon where we could gather by interest groups (or different institution types) and interact would be beneficial. The best sessions were the small workshops where there was specific discussion of practice. Small "ask the long timers" panels would be good, too.
- I think we need to devote a little more time to how we can come together and measure student learning, and the impact of the REU's. Also, I would be interested in learning more about best practices as to how PI research can benefit from REU mentorship.
- A session on grant panel review process
- It would have been nice to have the agenda a little earlier, but I understand that this was probably still in the works until just before the meeting. Also, the pre-meeting communication was coming from several people which got a little confusing- but again, it worked out fine.
- more advance notice of date
- Better speakers (evaluation speakers were not effective) and the breakouts were too short.
- The near constant changes to the schedule made things a bit challenging. My hotel room was a bit run down and the beds were horrible. I really felt like the quality of the hotel has gone down since the last 2 meetings. The location for the meeting is so convenient though. Ending the meeting on a Saturday at noon makes travel home somewhat challenging. My options were to leave Saturday morning or not get home until almost midnight on Saturday. I feel like it is best to have the meeting strictly during the week.
- Please do not schedule the meeting on a Saturday. Rosslyn Holiday Inn is not a superb venue. I will say: it is very convenient to the airport and to the Metro, and the rooms are

pretty good. I assume the price is quite competitive.
- Special session for new PIs with NSF reps to review details about budget or do's and don'ts. Some sort of new PI - established-PI Q&A.
- Integrate specific learning/discussion objectives into the breakout sessions, especially those on Saturday morning.
- The poster session room was far too small!
- questions from the audience in Ballroom sessions need to be amplified or repeated by the speaker; 2. The breakout summary sessions are not very valuable - much better to eliminate those and add more small breakout sessions
- The breakout sessions were a little short for what the presenters planned. Also, it would have been nice for the presenters to have access to a projector as much of the breakout sessions would have benefitted from showing resources or displaying text.
- Three sessions on last day was a bit much. I was exhausted by then and couldn't concentrate like I needed.
- It was great! More answers to the questions suggested by breakout session titles would have been great.
- None
- Please have a detailed schedule up early. The general schedule noted that the meeting was starting at 1 on Thursday so myself and many others from the western US flew out on Wednesday only to discover that we could have left Thursday morning and made it to the meeting in time for the poster session.
- None
- A session on renewing
- The poster session on Thursday evening was really good at the beginning. However, it got very crowded later and hard to talk to the presenter. Maybe a slightly bigger room for the poster session to spread people out a bit more would be better
- Be sure that each breakout reserves 1/2 the time for participants to exchange practices--some were lectures that only left time for presenters to speak. Also, be sure that deadlines are stated clearly on pre-workshop communications.
- More unstructured time for interactions - spontaneous workshops
- The breakout sessions on Saturday had so much potential but were very short and therefore somewhat useless. Whereas the plenaries took up an entire day and I got little from them.
- More informative plenary talks and minimal breakout sessions
- something more informative than break out reports would be helpful. Reporters are overviewing so much, its hard to get much from that session. Wonder if they could pick one thing to discuss more deeply, but the written report has everything.
- Clearer contact information before the meeting - I tried to ask about poster submission after registering and never got a reply until I heard from Jeri just before the meeting. She was great - super responsive, but by the time I found out about her as a contact, it was too late to put together a poster.
- none
- Many of the presentations and handouts were laden with abbreviations and acronyms that were difficult to follow unless one had -- I assume -- been a long-time recipient of an REU, or perhaps was member of the LC (case in point).
- More input from program officers. "summaries" read out by group reporters generally poor. I learned so much talking to folks at the Friday night dinner, more opportunities like this should be set up. keynote on communication was ironically, poorly communicated and put together -- vague at best.

10. Do you have any other comments or suggestions?

- The breakfast was very limited - no "brewed" decaf coffee or herbal tea.
- Not sure how effective the recommendations to the LC were delivered. Maybe form a list of questions during Day 1, then have a forum (e.g. over dinner) to discuss, then vote before we leave on Day 3?
- For new or "young" sites, both the PI and the co-PI should attend the conference to maximize learning best practices from experienced PIs.

- I think PIs should be told to bring laptops. I couldn't post changes to the common assessment tool because I didn't have a computer.
- Thank you for all of your time and effort. It was my first meeting as a Director and I am very glad I was able to attend. THANKS!!
- THANK YOU! The workshop was really helpful as new PIs. We appreciate all your help!
- Great job! Thanks for doing this!
- It was a well-run workshop. There was a good amount of time to network particularly through the break out groups.
- It's becoming more and more clear that if you do not have institutional support (mostly personnel) that you cannot do many of the things that the most successful programs are doing. It makes me question how much I want to continue to run my REU when I have to do everything and I'm not compensated.
- Thank you to the LC and NSF for a great meeting.
- I came away energized and with new ideas I am excited to try out! Thanks to everyone for their hard work!
- No
- There is a real need to develop better tools for mentor training, responsible conduct of research training, and ethics training. Real evaluation of those tools and how experienced people actually use and do not use them would be good areas to address.
- Thank you for all of your efforts.
- Overall, nicely done.
- wonderful workshop and I'm delighted I was able to attend. Thank you!
- Thanks for doing this!
- The colored dots were confusing. Maybe just put the number of years/meetings attended would be more straightforward. I'm still not sure what some colors meant and why some didn't have a dot.
- Thanks to the leadership committee for their efforts! The workshop is well worth it!
- Much appreciation to the organizers for their hard work, facilitation, and behind the scenes planning and implementation.
- Very well run and very helpful.
- Thank you! This was fantastic. Exactly what I needed as a new REU.
- None
- No
- Thank you for all that you have done!
- Janet et al did an outstanding job making this meeting successful and efficient
- I learn so much from talking with other participants. Overall the plenaries are a less valuable use of time than setting a topic, highlighting a challenge, and allowing participants to discuss in small groups. So I would recommend 2 plenaries in favor of more time for small group discussion.
- Great job overall! Very positive vibe and Ian's talk got us past just nuts and bolts type issues.
- I think that the workshop had a nice blend of information for participants with new sites as well as participants who have managed sites for many years. The breakout sessions seemed to be excellent for sharing knowledge too.
- I rated registration low because we were not sure who was coming from our institution. I registered late, but still almost 2 weeks before the conference. Nevertheless, I felt that my presence was totally unexpected, in that there was no name tag, packet, etc. I was given meal tickets and everything, but it was an off-putting way to start.
- Thank you for your hard work.
- I would have appreciated more presentations on practical how-to-do-it, e.g., prepare an evaluation, prepare a report for NSF that wouldn't be returned, rather than so much talk from current REU PIs about "what we do in, e.g., Minnesota.