

Staff Response
To the Committee of Visitors (COV) Report
Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)
COV Meeting of December 8-9, 2009

On December 8-9, 2009, a Committee of Visitors was convened to review the years FY2006–2008 of the Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP). The program staff thanks the COV members for their review of the program and helpful suggestions. The response here addresses the comments and issues that were included in the COV report. Responses are organized in accordance with the order provided by the FY 2009 Report Template for NSF Committees of Visitors.

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

A.1.1. Regarding questions about the quality and effectiveness of the program's use of merit review process, the COV "noted no site visits in our sample and realizes the limitation of staff time and dollars. Travel budget reductions notwithstanding, we feel there are transformational things that happen when actual site visits occur. Preparation for and engagement in a site visit activates the campus or division and increases the potential impact of the project. Also, a site visit often surprises some faculty who may not have been aware of the proposal and signals the need for their involvement. The COV recommends developing ways to replicate site visits. For example, consider using previous "Rotators" for some site visits as it is likely to reduce travel time and cost."

Response: Program staff notes that, like most programs at NSF, STEP does not use pre-award site visits as part of the merit review process. Rather, when necessary, program officers solicit additional information from the principal investigator(s) and others at the institution. Given the relatively modest size of the STEP awards, the relatively large number of awards made each year, and the tight schedule under which actions must be completed, program staff does not anticipate implementing the use of pre-award site visits. Program officers working in STEP have carried out post-award site visits to STEP projects over the years since the program was started. In the spring of 2010, a special project was funded to a former rotator who worked in STEP. That project includes funds for a limited number of site visits, so program staff expects to see an increase in the number of STEP projects that are visited. The program expects to continue the judicious use of site visits by active program officers as well. A.1.6. Regarding the question as to whether the documentation to the PI provides the rationale for the award/decline decision, the COV commented "Based on examination of context statements, Program Officer comments, individual reviews and panel summaries, we are of the opinion that sufficient rationale for the award/decline decision is provided to the principal investigator(s). However, we encourage more detailed responses to all PIs, and especially to those who were unsuccessful in order to give them a stronger and more informed base from which to strengthen future proposals. Assist first time reviewers with examples of helpful reviews."

Response: Program staff is pleased that the COV noted in A.1.6 that sufficient rationale is provided to the PIs, and that under A.1.8 the COV commented "The merit review system is effective and provides adequate and useful feedback to the Principal Investigator(s) to conduct successful projects for those awarded or to resubmit for those declined. The reviews reflect the diversity of the reviewers' expertise." While program staff understands the preference for extensive, personalized, and detailed responses to unsuccessful applicants, the NSF staff is forced to find efficient and effective ways to serve the community. Program officers in STEP are careful to make certain that major shortcomings in proposals are clearly pointed out to unsuccessful applicants. However, program staff does rely on the fact that applicants have access to the information and helpful comments that are found in the panel summaries and the individual reviews, so the staff refers PIs to these comments and does not usually repeat these comments. The program staff does not see significant differences between the reviews from first time reviewers and those from more experienced reviewers. Apparently the combination of the written information provided to all reviewers and the webinars that are available to all reviewers is successful in supplying the necessary background so that both first time and experienced reviewers start out on a level footing.

A.2.2. Regarding questions about the selection of reviewers with respect to geographical distribution, the COV presented an analysis that they carried out using data from the reviewer pool. They concluded "We see evidence that the NSF pays appropriate attention to getting reviewers from all regions of the country, including the central region." Their next comment was "The COV has concerns that reviewers from the south and perhaps EPSCOR do not seem to be sufficiently represented."

Response: Program staff will continue to strive for appropriate geographical distribution of the reviewers.

A.3.7. Regarding the question of whether the program portfolio has an appropriate balance of awards to new investigators, the COV noted "100% of the PIs who have received STEP funding have previously served as PIs on NSF grants; about 50% of the declined proposals were from PIs who have not previously served as a PI on an NSF grant. Therefore, it appears that previous success as a PI has resulted in a much greater probability of success in the STEP. We recommend that NSF look for ways to increase the number of new PIs – training, Webinar..."

Response: While program staff understands and appreciates the importance of NSF's goal of making awards to new investigators, the institutional nature of STEP awards makes the likelihood low for new investigators being successful in the program. Proposals are judged by reviewers and NSF staff on the basis of whether the project is addressing important institutional issues, whether the PI has the stature on campus to involve and lead many departments in the effort, and whether the PI has the experience to manage a five-year project that must integrate a number of strategies and coordinate a large mix of personnel. Generally, successful PIs have significant experience at the institution and tend to be at least associate professors, if not full professors, chairs, or deans. At most institutions senior faculty who are regarded as credible leaders in STEM have had support for their research programs and, commonly, support for other curricular or departmental or institutional projects. For STEM faculty a common source of such support is NSF. Thus, the very factors that make a STEP project review well are the same

factors that make it likely that a successful PI will have had prior NSF support. Within projects, however, teams of faculty work together, and less experienced faculty typically are involved in these teams. Thus, program staff regards STEP projects as including excellent training opportunities for newer faculty. Program staff does continue to remain open to awarding STEP grants to new PIs.

A.4.1. Regarding the Third Year Review process that is a part of the management of the program, the COV commented "Additionally we noted less diversity in year 3 reviewers than desirable. Community colleges and minority serving institutions would benefit greatly from better representation on the Year 3 review panels."

Response: The institutional affiliations were provided only for former program officers who served as reviewers, so the COV was not able to see the fact that the longer "NSF/DUE staff" list included rotators from community colleges and minority serving institutions who also served as reviewers. In any case, program staff agrees that institutional diversity is important among the reviewers for the Third Year Reviews, and the staff will continue to seek institutional diversity.

A.4.2. Regarding the composition of the STEP Type 2 awards, the COV commented "We also suggest placing stronger emphasis on some of the non-traditional educational practices which have been shown to increase student interest in STEM fields. Examples of these initiatives include: incorporation of service-learning activities at an early level; creation of college-industry alliances early in the college experience; insurance that first-year initiatives to attract new students into STEM careers are continued and strengthened throughout the undergraduate experience; connections between two and four-year institutions are relatively seamless so that barriers to transfer to undergraduate degree programs are minimized; and incorporation of ICT to enhance learning, etc." and further noted "The COV recommends that more grants focus on some emerging education practices that feed into the 2- and 4-year programs including Early College High Schools, dual and concurrent enrollment, and Pathways" and also suggested "We further recommend that future grants look more at the emerging practice of virtual learning environments, effective use of technology and industry based experiences through exploration from both a research and a practice focus."

Response: The program staff agrees that appropriate research proposals submitted under the STEP Type 2 track that deal with the issues mentioned by the COV would be considered for review and funding within the constraints of the track. The constraints are that one or two Type 2 proposals are funded each year, that the track does not fund evaluations of projects, that the track does not fund reviews or compilations of information, and that the track does not provide for PIs to advocate for the implementation of strategies. Rather, the STEP Type 2 track has been designed to support PIs who wish to pose research questions around issues of student achievement in STEM undergraduate education.

PART B. RESULTS OF NSF INVESTMENTS

B.1. With regards to the research undertaken by STEP Type 2 grants, the COV remarked "Surprisingly enough, research on the use of technology to engage, reach and teach students at both the high school-feeder level and at the university level is still minimal. We recommend

exploring possibilities that make use of the cyberlearning initiative, as well as exploring the effectiveness of other virtual learning and non-traditional classroom environments.

Response: As mentioned in the Response to A.4.2 above, program staff agrees that appropriate proposals submitted under the STEP Type 2 track that ask a significant research question around questions of student achievement that involve the use of technology or findings from the cyberlearning initiative would be considered for review and funding within the constraints of the track. However, the STEP Type 2 track is not intended to answer basic research questions about the best ways to implement the use of technology in particular situations. Those kinds of research questions should be submitted to REESE and other NSF research programs.

B.2. With regard to the learning goal to "cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens," the COV noted "While most of the STEP proposals we reviewed focused on students who already have expressed some interest and capability in STEM areas through the STEP proposal guidelines, we recommend reinforcing the importance of inclusion of scientific literacy to all students in STEP projects."

Response: The COV itself noted "The STEP program has been designed to increase the number of students completing STEM majors. As such, it does not address the literacy of all citizens, and so it does not meet the second part of this outcome goal." The NSF staff will continue in STEP to focus on cultivating a world-class, broadly inclusive science and engineering workforce. A number of other programs at NSF include within their mandates attention to the scientific literacy of all citizens. Only two programs (LSAMP and STEP) are focused directly at increasing the number of students earning undergraduate degrees in STEM, and program staff is committed to keeping STEP focused on this extraordinarily difficult task.

PART C. OTHER TOPICS

C.1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

With regard to Program Management, the COV suggests "Increase The Number of Site Visits Due to Transformative Value to Institutions."

Response: As also noted in the staff Response to A.1.1 above, program officers working in STEP have carried out site visits to STEP projects over the years since the program was started. In the spring of 2010, a special project was funded to a former rotator who worked in STEP. That project includes funds for a limited number of site visits, so program staff expects to see an increase in the number of STEP projects that are visited. The program expects to continue the judicious use of site visits by active program officers as well.

With regard to Program Management, the COV also recommended "Develop Assessment Tools to Determine Program Successes, and Strengthen Institutional Research Data Bases."

Response: The materials presented to the COV included details of the existing STEP Monitoring System, and a description of the proposed program evaluation. The program staff will continue with these plans. As an agency, NSF does not dictate the composition of

institutional research data bases. However, the ongoing requirements of many NSF programs that ask for data, as in the STEP Data Monitoring System, undoubtedly do apply the kind of indirect pressure that encourages institutions to strengthen their institutional data bases.

With regard to Reviewers, the COV noted that they "Encourage Reviewers to Provide More Substantive Comments to Support Funding Proposals. Provide Examples of Excellent Reviews. Increase the Number of Community Colleges and MSIs on Third-Year Review Panels. Ensure That Panel Membership Includes Educational Research Expertise."

Response: NSF staff will continue to provide webinars and written instructions so that reviewers will continue to provide substantive reviews. Many programs have provided examples of excellent reviews to reviewers, and most of these programs have found that this practice, unfortunately, encourages "cookie cutter" reviews. Thus, STEP will continue with its focus on webinars and written instructions. (See comments above under A.4.1. about Third Year Review Panels.) For STEP Type 2 panels, almost all of the reviewers have educational research expertise, as is appropriate for reviewing the STEP Type 2 proposals that involve research studies. For STEP Type 1 panels that are reviewing implementation proposals, reviewers include faculty who have experience in educational reform and with the educational infrastructure at academic institutions.

With regard to Principal Investigators (PIs), the COV noted that the program should "Expand the Pool of Successful PIs; Provide Mentoring and/or Training for First Time Proposers; Encourage PIs to Develop Leaders to Fill the Pipeline With a Cadre of Experts."

Response: See the comments above in the response under A.3.7. for an explanation of why First Time Proposers to NSF are not likely to be PIs for STEP projects. Again, as mentioned in that response, the use of teams within projects is leading to the development of new leaders.

With regard to Principal Investigators (PIs), the COV also noted that the program should "Increase Success Rate for Resubmissions, Openly Encourage PIs to Communicate Directly with POs, Provide More Information in Reviews to Unsuccessful Proposers."

Response: Of the STEP Type 1 awards made each year, program staff estimates that about 75% of the awards represent projects that have been resubmitted. The program staff will continue the existing effective practices that allow PIs to improve their proposals to the point that they are selected for awards in subsequent years. PIs are encouraged to communicate directly with program officers in two ways. The "General Information" sheet sent to all applicants along with their reviews includes the statement "Please feel free to contact the cognizant program officer if more information would be helpful." In the letter from the Division Director sent to all PIs whose proposals are declined, the statement is included, "If you would like further information concerning the review of your proposal, please contact the cognizant program officer whose name, email address, and telephone number are provided below." As noted above in the staff Response to A.1.6, while program staff understands the preference for extensive, personalized, and detailed responses to unsuccessful applicants, the NSF staff is forced to find efficient and effective ways to serve the community. Program officers in STEP are careful to make certain that major shortcomings in proposals are clearly pointed out to unsuccessful applicants.

However, program staff does rely on the fact that applicants have access to the information and helpful comments that are found in the panel summaries and the individual reviews, so the staff refers PIs to these comments and does not usually repeat these comments.

With regard to STEM students, the COV recommended that the program " Increase Number of STEM Graduates by Meeting Pent Up Demand for STEP Program; Fully Fund A Significantly Higher Number of Quality Proposals; Tie Funding Goals to National Priorities; Increase Cross-Agency Collaboration."

Response: These recommendations require actions at a level above the program and division level. Program staff has asked the Director for the Division of Undergraduate Education to refer these recommendations to the Assistant Director for EHR and to the Director for NSF.

C.1. With regard to STEM Students, the COV also recommended that the program "Encourage the Integration of Liberal Arts and STEM."

Response: In order for STEP to meet its Congressionally-mandated goal of increasing the number of undergraduate degrees in STEM fields, the STEP Solicitation asks that PIs design projects that adapt and implement known best practices that have been shown to increase the number of students obtaining undergraduate STEM degrees at other institutions. However, the Solicitation does allow PIs to propose the use of innovative strategies and calls for the PI to include compelling arguments for why these strategies are expected to result in an increase in the number of students earning STEM degrees. Thus, PIs are welcome to propose the integration of liberal arts and STEM as a strategy under these conditions.

C.1. With regard to Sustainability, the COV recommended that the program should "Provide Funding Support for Replication of Successful Programs, and Utilize Accepted Educational Research Methods for Determining the Outcomes of the Project."

Response: Both of these suggestions currently are integral parts of STEP.

C.1. With regard to Sustainability, the COV also recommended that the program should "Encourage Shared Funding With Public/Private Partnerships to Increase Impact and Sustainability, Improve Knowledge Management to Fund High Quality Proposals, and share the best practices and research with other mission agencies is critical, as is sharing with the Dept of Education to inform such programs as the Noyce Scholarship program; perhaps indicating that over time, the ability for an institution to receive funding was in part dependent on demonstrating evidence of implementing some of these highly effective strategies."

Response: These recommendations require actions at a level above the program and division level. Program staff has asked the Director for the Division of Undergraduate Education to refer these recommendations to the Assistant Director for EHR and to the Director for NSF.

C.3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

The COV recommended "Allocation of resources is critical to setting and funding national priorities. The global perspective calls for a unique vision so that projects add value to resources and take advantage of evolving pathways. To shape the future, we recommend focusing on emerging areas of science, in particular, Cybersecurity and Energy. This emphasis will facilitate more effective choices for non-traditional STEM students and encourage increased international STEM experiences. We advocate collaborating with the Cyberlearning Initiative and making it a high priority. Additionally we encourage a research agenda that explores and highlights the effective and innovative use of technology. We also suggest building on emerging educational trends including early college high schools and concurrent/dual enrollments.

"To further look ahead, we recommend driving Cross-Agency collaboration to facilitate efficiency and a return on the investment of resources. By increasing the funding of high quality grants via public and private partnerships, NSF has an opportunity to realize significant gains in the improved dissemination of the most promising strategies."

"An important agency-wide issue, indeed a national issue, is the overall support for undergraduate education in STEM fields throughout the entire undergraduate experience. STEP is an essential step toward increasing STEM graduates with most of the proposals focused on the first year experience of students in STEM disciplines. We feel it is appropriate to begin to address the number of STEM graduates by focusing on the first year of instruction. At this level we find the greatest attrition of students who have shown interest and aptitude in STEM fields. However, high quality teaching, curricular innovations and activities begun in the first year will set expectations for subsequent years. If these expectations are not fulfilled, particularly in the second year (often referred to as the "sophomore slump"), many of those students who were "on the bubble" in the first year will decide not to pursue STEM careers, even though they have the talent to do so. Therefore, we suggest that NSF in general, and STEP in particular, urge proposers and reviewers to look for programs that show promise for and commitment to continue and build upon what is found to be successful in the first year STEP. Such a comprehensive undergraduate STEM experience will need new and expanded NSF funding. Support for the development of some model STEP programs which reach throughout the undergraduate educational experience, along with inclusion of a rigorous learning outcomes and assessment program, should become transformational in the STEM undergraduate educational programs. (Think of the extraordinary initiatives developed in the sixties in response to Sputnik and our own "Man on the Moon" projects. Today's shortage of US citizens in science and technology fields is similar.)"

"This might also suggest and reinforce the recommendation to provide a greater focus on other issues of national security that can tap the hearts, minds, creative and competitive talents and spirits of our nation's youth in similar ways. Creating these cross disciplinary, cross program and cross mission agency 'call to action' in areas like energy, sustainability and cyber security could finally address the cry of many for "the next Sputnik"."

Response: Although STEP projects are allowed to address students beyond the first year, and many projects do so, at almost all institutions the data show that the greatest challenges to the retention of students in STEM occur at the first-year level. Others of these suggestions represent issues that must be addressed at the agency level. Program staff has asked the Director for the

Division of Undergraduate Education to refer these recommendations to the Assistant Director for EHR and to the Director for NSF.

C.4. Please provide comments on any other issues the COV feels are relevant.

The COV noted and recommended "The COV discussed the issue regarding the size of the grant that an institution receives and found it is directly tied to the size of the institution vs. the number of students reached by the school. For instance a large institution might address a smaller number of students than a medium sized institution but would still receive more funding due to the institution size. The COV recommends reviewing the number of students impacted as a larger component of the funding allocation, in addition to the size of the institution."

Response: Program staff agrees that a cost/benefit analysis is highly important when comparing proposals prior to funding, and program staff uses an analysis that includes three major components. First, the projected increase in the number of STEM graduates given in the proposal may not be realistic in light of the strategies that have been proposed. Second, the project management may not appear sufficiently strong to guarantee that the proposed strategies will be successfully implemented in a timely fashion. Third, the types of strategies proposed and the degree of institutional involvement and support in the proposed project may suggest that some or all of the strategies will not be institutionalized or sustained beyond the duration of the grant. Funding decisions are made after a careful analysis by reviewers and program staff of the impact of these major components on the cost/benefit ratio.

C.5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

The COV noted "Our only recommendation is to refine the meeting agenda to more closely match the actual procedures. Perhaps this change would be possible by working with the writer and having the writer participate in the Webinar to provide a brief overview of the work plan."

Response: This recommendation referred to the suggestion by the COV Chair that a detailed work plan provided to the panel by the Program Lead for all of the work of the COV and for the distribution of the work among the COV members could be helpful. During the next COV cycle, the program lead will work with the Chair to provide a more comprehensive outline of work and its assignment to panel members.