

**FY 2017 REPORT TEMPLATE FOR
NSF COMMITTEES OF VISITORS (COVs)**

Date of COV: October 24-25, 2016
Program/Cluster/Section: EHR Core Research (ECR) Program
Division: Division of Research on Learning in Formal and Informal Settings (DRL)
Directorate: Education and Human Resources (EHR)
Number of actions reviewed: 103 Awards: 21 Declinations: 78 Other: 4
Total number of actions within Program/Cluster/Division during period under review (FY13-15): 842 Awards: 140 Declinations: 691 Other: 11
Manner in which reviewed actions were selected: To create a sample of jackets, all actions ending in a 4 were selected for the sample. These included new awards as well as supplements

COV Membership

	Name	Affiliation
COV Chair or Co-Chairs:	Dr. Mark Lipsey	Vanderbilt University
COV Members:	Dr. Alicia Dowd	Penn State
	Dr. Marie Hammond	Tennessee State University
	Dr. Sharon Lynch	George Washington University
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MERIT REVIEW CRITERIA

An understanding of NSF's merit review criteria is important in order to answer some of the questions on the template. Reproduced below is the information provided to proposers in the Grant Proposal Guide about the merit review criteria and the principles associated with them. Also included is a description of some examples of broader impacts, provided by the National Science Board

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These broader impacts may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities. These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. Both criteria are to be given full consideration during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. ([GPG Chapter II.C.2.d.\(i\)](#) contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including [GPG Chapter II.C.2.d.\(i\)](#), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to:

a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and

b. Benefit society or advance desired societal outcomes (Broader Impacts)?

2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

4. How well qualified is the individual, team, or organization to conduct the proposed activities?

5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

3. Examples of Broader Impacts

The National Science Board described some examples of broader impacts of research, beyond the intrinsic importance of advancing knowledge.¹ “These outcomes include (but are not limited to) increased participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education at all levels; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a globally competitive STEM workforce; increased partnerships between academia, industry, and others; increased national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education. These examples of societally relevant outcomes should not be considered either comprehensive or prescriptive. Investigators may include appropriate outcomes not covered by these examples.”

¹ NSB-MR-11-22

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, returns without review, and withdrawals) that were *completed within the past four fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?</p> <p>Comments:</p> <p>The review methods used for <i>EHR Core Research (ECR): Fundamental Research in STEM Education</i> are the standard methods employed by NSF and certainly are appropriate. The solicitation admittedly covers a great deal of ground in that it has folded in several older and established programs across EHR divisions to create a new program aimed at <i>fundamental research</i> on STEM Learning and Learning Environments, STEM Professional Workforce Development, and, Broadening Participation in STEM.</p> <p>Site visits are not relevant here for this program.</p> <p>Data Source: EIS/Type of Review Module</p>	YES
<p>2. Are both merit review criteria addressed</p> <p style="padding-left: 20px;">a) In individual reviews?</p> <p style="padding-left: 20px;">b) In panel summaries?</p> <p style="padding-left: 20px;">c) In Program Officer review analyses?</p> <p>Comments:</p> <p>The overall assessment of the COV members on this matter is that, though the merit review criteria are addressed, they are not addressed as fully as they should be. The individual reviews did not always address both merit criteria in a substantive fashion. Historically, some of the older programs may have had less</p>	YES

emphasis on the research component of funded projects, while others have had their roots deeply embedded in cutting edge foundational research. Reviewers came from different traditions and programs, and perhaps as a result, reviews varied in quality and how well they addressed components of the merit criteria. The challenge will be to have *all* of the reviews address the criteria of NSF merit reviews with high levels of quality. Alternatively, the review panel as a group should have the expertise to ensure that any one proposal would get high quality feedback from the reviewers assigned to it, in aggregate. This seemed to be the case for some review panels where great care was taken to get strong substantive reviews, but not others.

Under the intellectual merit criterion, individual reviews regularly provide an assessment of the problem being addressed in the proposal but often do not provide a full assessment of the research plan and methods (see further comments in the response to question 3 below). Some proposals, in particular, would have benefited from a careful review of their qualitative methods. The comments seemed to be more detailed for proposals with quantitative methods. Mixed methods proposals also could have benefitted from more feedback about qualitative components. All of these methods have an important role in ECR research and therefore should be assessed fully and according to standards appropriate to the respective methods.

The reviews suggested that it was not always clear to reviewers what “Broader Impacts” should mean for a program focused on fundamental research. Some reviews seemed to ignore this criterion, or demonstrated that both the researchers and the reviewers were uncertain about what broader impacts should mean for ECR. The COV discussed broader impacts in the ECR context at some length, recognizing that “transformational” impacts did not necessarily mean “high risk.” Impacts should help shape their fields from the standpoint of theory and/or synthesis, but not focus prematurely on a rush to implementation, nor get buried in obscure journals or websites. How the field comes to understand and use ECR findings given its “fundamental” goal, might take more thought than for other NSF programs.

It appeared that panel summaries were more thorough and complete than individual reviews. They too focused more on intellectual merit than on broader impacts. In the context of research, it is hard to have the latter without the former. For some panels, the summaries failed to provide adequate feedback on methodology.

In general, the POs’ review analyses were thorough and contained detail about the panel discussions and how a decision was reached. This was particularly true for awarded proposals and for declines that had some positive reviews or were rated as being competitive.

COV Recommendation:

Intellectual merit should encompass both the problem addressed by the proposal and the quality of the research plan and methods for addressing the problem. The COV believes that it is important to ensure that all panels include methodological expertise in qualitative and quantitative methods, as appropriate. This role should not be left to the PO in the review analysis. While

<p>some POs have more expertise in this regard than others, ensuring that the panels have the right mix of reviewers is critical.</p> <p>Data Source: Jackets</p>	
<p>3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals?</p> <p>Comments:</p> <p>The COV members overall assessment on this item is that the written reviews did not always provide substantive comments that explained the assessment of the proposals. When examining the range of reviews for the proposal in the COV sample, it was apparent that some reviews were well done according to the NSF merit review criteria while others were cursory. Of particular concern were reviews that:</p> <ul style="list-style-type: none"> • Failed to adequately review the appropriateness, quality, and feasibility of the research methods to be used. • Failed to address broader impacts in a way that was appropriate to the nature of the fundamental research ECR is designed to support. • Included review text that did not match the rating, e.g., glowing text with a rating of “good” with little indication of the problems within the proposal that caused it to be declined. • Were so cursory that they could not help the investigators understand how to improve the proposal—this was particularly a concern with triaged proposals for which the PI would likely get no substantive panel summary or PO letter, and would have to rely solely on individual reviews. <p>However, we do want to emphasize that in many other cases the reviews were thoughtfully undertaken and covered the NSF review criteria thoroughly, as well as reflecting deep expertise and providing substantive comments that would help the researcher understand how to improve a proposal or understand why it was not aligned with the requirements for the ECR program. The COV believes that the fullest feasible feedback to applicants, including those with triaged or low-rated proposals, is beneficial both for facilitating submission of stronger future proposals and for informing the population of relevant researchers of the expectations for proposals submitted to the new ECR program.</p> <p><u>COV Recommendations:</u></p> <p>Encourage staff to find ways to facilitate complete and informative reviews for all proposals. Some approaches that might be considered are expanded training for reviewers (especially new reviewers), not inviting weak reviewers to future panels, and making the expectations for quality reviews more explicit during the review process.</p> <p>Develop program-specific criteria for the ECR program that elaborate the expectations for how the NSF-wide review criterion quoted below can be applied to ECR proposals. This would help ensure thorough and appropriate assessments of the research plan and associated methods:</p>	<p>NO</p>

<p>“Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?”</p> <p>Data Source: Jackets</p>	
<p>4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?</p> <p>Comments:</p> <p>Summaries were generally adequate syntheses of the reviewers’ comments. However, the degree to which these summaries convey the discussion of the panel or reviewers’ concerns varied across the sample available for this COV. The nature of reviewer disagreements could be better documented.</p> <p>Data Source: Jackets</p>	<p>YES</p>
<p>5. Does the documentation in the jacket provide the rationale for the award/decline decision?</p> <p>[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.]</p> <p>Comments:</p> <p>The COV felt that in most cases the reasons for awarding the grant or declining to make an award were clear; however, in a few instances this rationale was inconsistent and/or incomplete. The apparent consensus from the panel review sometimes did not seem to be consistent with the award decision, and the criteria by which proposals are selected for further consideration and either awarded or declined in opposition to the panel’s consensus are not clear. For some declines it is hard to tell if there were additional conversations about the grounds for the decision. In reviewing the jackets, it was not possible to tell whether or not all discussions leading to the final decision were documented.</p> <p>Data Source: Jackets</p>	<p>YES</p>
<p>6. Does the documentation to the PI provide the rationale for the award/decline decision?</p> <p>[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]</p> <p>Comments:</p> <p>The overall assessment of the COV members was that even though the documentation to the PIs provided the rationale for the award/decline decisions, there was considerable variability in the feedback ranging from thorough and</p>	<p>YES</p>

<p>detailed explanations to boilerplate responses. There were a few cases in which the rationale for the award/decline did not seem consistent with the majority opinion in the review. The COV noted a number of cases in which great variability in the assessments provided in the reviews was addressed and explained in significant detail by the PO response to the applicant and in the review analysis, but this practice is not consistent across proposals. Some boilerplate responses did not seem to have been updated to fit the reviews or the content of the proposal. For PIs these boilerplate responses may make them perceive that NSF is not interested in future proposals when that is not necessarily the case.</p> <p>The fact that the program is quite new and the staff is numerous and adjusting to change may be a reason for this variability. It may require some deliberate action on the part of the organization to calibrate the process as practiced by the range of POs involved to insure that all proposals receive equal treatment.</p> <p><u>COV Recommendation:</u></p> <p>For purposes of broadening participation and informing applicants of the expectations in this new ECR program, the COV suggests giving particular attention to providing informative feedback to declined proposals.</p> <p>Data Source: Jackets</p>	
<p>7. Additional comments on the quality and effectiveness of the program's use of merit review process:</p> <p>The specific meaning of the terms used to describe the program (foundational/fundamental, etc.) and the implications for the merit criteria, both intellectual merit and broader impacts, deserve a closer look and explanation in future solicitations and program documentation. Since this is a new program aimed in part at creating a new culture of research, expectations and perceptions by the community (and even some staff members) may require more explicit explanations on the program's scope and intent.</p>	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Did the program make use of reviewers having appropriate expertise and/or qualifications?</p> <p>Comments:</p> <p>The panels appear to be constituted based upon the group of proposals to be reviewed at a given time, with content expertise clearly related to the assigned proposals. The COV commends the POs for their diligence in recruiting groups of content experts who can do justice to the proposals submitted.</p> <p>It was noted that some panels have included a significant proportion of new reviewers. This presents an opportunity to provide additional support so that these panel members can produce high quality reviews from the start. This is especially important when addressing methodological issues, which were less clearly documented in expertise listings and in both panel reviews and summaries. In addition, panelists often seemed to lack clarity about how to adequately assess broader impacts. Additional support through explanatory materials or additional information in the solicitation itself may be effective ways to address this issue.</p> <p>The COV was happy to note the many cases where additional reviews were solicited to expand the expertise of the original panel. Moreover, each “likely” proposal seemed to have gotten the benefit of two or more PO reviews. However, the COV found a few proposals where the PO’s reviews differed from panel summaries such that the POs seemed to be providing technical reviews themselves that overrode the panel’s assessment. While the expertise of the POs is valued and appropriate, a concern was raised about whether such circumstances aren’t better handled by calling in additional reviewers with the relevant technical expertise.</p> <p>Data Source: Jackets</p>	<p>YES</p>
<p>2. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p>Comments:</p> <p>The processes in place for resolving conflicts of interest are appropriate.</p>	<p>YES</p>

Data Source: Jackets	
3. Additional comments on reviewer selection: The racial/ethnic diversity of the review panels is difficult to assess given the insufficient available data.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW

1. Management of the program.

Comments:

The COV recognizes the inherent challenge involved in managing a fundamental research program that spans the entire EHR Directorate and includes educational research in formal and informal settings, kindergarten through adulthood, in all STEM disciplines and incorporating the whole gamut of educational and psychological research methodologies, not to mention the additional challenge of having a large cadre of POs manage the program. The changes that the program has experienced in its first three years are certainly a result of its still ongoing maturation process. Our comments and recommendations below are based on a review of the Management Plan and other COV documents, the jackets, discussions with the lead and other POs, and our internal deliberations.

We commend and fully support the need for fundamental research and the vision of the ECR program as articulated by the EHR administration and POs. Furthermore, we are pleased to hear that the ECR program, in addition to conveying to the community the importance the directorate places on fundamental research, has also started to influence the research orientation of other EHR programs.

To hasten these welcome changes in both the community and within the directorate, we believe that it is important to develop and maintain a shared vision of fundamental research, and how it differs from other research, development and implementation activities supported by the directorate. The ECR POs should be able to provide consistent advice in response to inquiries from the field and consistently identify and promote high quality proposals in their panels. While POs are experts in their own areas, they are also accustomed to the expectations of the other EHR programs assigned to them. To the extent that these expectations differ from those of ECR, developing a common understanding and subscribing to the research orientation of ECR is important for the POs to function as a cohesive team. This comment is by no means intended to minimize the importance of a multiplicity of intellectual perspectives on fundamental educational research or their airing in post-panel PO discussions. Rather, the intent is to ensure that such discussions take place in the context of a shared view of what counts as fundamental research. Such a shared view will help (1) develop and maintain a consistent research orientation in ECR's project portfolio across its very broad scope, (2) communicate this vision to the research community when PIs are given advice as to what kinds of projects are appropriate for ECR, and (3) enrich the research culture across the directorate.

In this regard, the COV had some concern about staffing ECR with a large number (currently 17) of POs, all or most of whom have other programs for which they are responsible. This arrangement has the advantage of connecting ECR with the other EHR programs (and vice versa) and representing all the EHR divisions in ECR management, as well as distributing the ECR workload. But it also has inherent potential for a fragmentation of involvement and commitment to ECR that could work against development of a shared coherent vision and adoption of relatively uniform procedures and perspectives across the diversity of ECR research proposals and review panels. The COV believes that a smaller group of POs, each with a larger role in ECR, could significantly

benefit the program by providing those POs with a more focused opportunity to develop and maintain a shared vision and to facilitate continuity and organizational memory.

Having that smaller group of POs assigned *exclusively* to ECR, however, would undermine the valuable network of connections across programs and divisions that the current arrangement provides. The COV believes that would go too far in consolidating the ECR staffing and run the risk of creating an ECR silo that would limit ECR as a directorate-wide program. A more attractive option might be an ECR team comprised of one or perhaps two representatives from each division, each with a role in the respective division but with primary responsibility for ECR during staggered terms of service. The term of service for the ECR lead PO, rotated among the EHR divisions, however, should be long enough to facilitate stability and continuity, e.g., three to five years.

COV Recommendations:

The COV does not feel that it is in a position to make very specific recommendations on this point, but does want to encourage consideration of various revised arrangements for PO roles in ECR that would allow for a smaller more cohesive management group and provide greater opportunity for the development and maintenance of uniform procedures and a coherent vision.

Since turnover among the POs managing the program is inevitable, and in many ways desirable, maintaining organizational memory will present significant challenges, especially with regard to procedural practices. Steps toward addressing this challenge that the COV recommends for consideration include:

1. Holding annual PO meetings to jointly discuss, share, and enhance the ECR vision prior to the start of the proposal handling period, with documentation of the outcomes of these meetings for future use and orientation of new POs and review by POs assigned to other programs.
2. Developing a set of program-specific review criteria that address specific expectations of ECR proposals not necessarily shared by other programs, e.g., relating to features of qualitative and quantitative methods that reviewers should consider and comment upon in some depth.
3. Addressing the variability in panel reviews by developing processes such as:
 - a. Maintaining a shared database of qualified panelists that the program uses to recruit for all the panels.
 - b. Populating the list with descriptions of both content area expertise and research methodology expertise of each potential reviewer.
 - c. Collectively reviewing and updating this list annually, and having incoming POs or rotators contribute to this list.
 - d. Holding post-panel assessments that consider reviewer performance and adjust the reviewer list to drop weak reviewers.
 - e. Ensuring that appropriate methodology experts are included in every panel.
 - f. Ensuring breadth of expertise in assigning POs to run panels and POs who do second reads. Further, because of the large number of POs involved in ECR, undertaking efforts to assist POs to coordinate in ways that help ensure that the review process is as consistent as possible across panels.
 - g. Revising the procedures for training new ECR reviewers and refreshing experienced ones to ensure that all reviewers are fully informed about what makes a useful and informative review for the specific nature of the ECR program. Such training might, for instance, include examples of appropriate and inappropriate reviews.
 - h. Having the POs, helped by a program assistant if necessary, read individual reviews before a panel is concluded to ensure that they address program specific criteria as well as Intellectual Merit and Broader Impacts and meet some minimum expectation of depth.

- i. Clarifying and standardizing to some extent post-panel processes, e.g., with regard to what should trigger post-panel negotiations with the PIs likely to receive funding in response to technical content and questions raised by reviewers and POs. The COV found several cases of extensive negotiations that ultimately enhanced the quality of the subsequently funded projects, but other cases in which the assessment of the panel reviewers and the questions raised were substantially similar but no such negotiation was documented.

The COV further recommends that any changes in program management and processes be explicitly stated in the next Management Plan. The current plan does not include specifics about PO recruitment, panel management, and post-panel processes in sufficient detail to support consistency across PO and panel functions.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:

The ECR program, being a directorate-wide fundamental research program, is very well-placed to be responsive to both emerging research and education opportunities, and indeed to influence emerging trends in those areas. We did not see direct evidence of that, but this is understandable given that ECR has been in place for only three years. The COV recognizes that the charge to ECR is broad enough to encompass such opportunities, and some of our suggestions for capitalizing on this capability appear in Section IV below.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

Many of the comments above as well as those in Section IV below pertain to this and therefore are not repeated here.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

Not applicable as this is the first COV.

IV. Questions about Portfolio. Please answer the following about the portfolio of awards made by the program under review.

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity?</p> <p>Comments:</p> <p>The overall assessment of the COV members was that the ECR program portfolio does not yet have a fully appropriate balance of awards across the disciplines and sub-disciplines. While STEM disciplines and fields related to education and learning are well represented in the research teams receiving awards, other disciplines that have the potential to contribute to fundamental research in ECR are not so well represented. Such disciplines might include, for example, economics, sociology, cognitive science, organizational behavior, public policy, and anthropology.</p> <p>Another perspective on the representation of disciplines is to consider the topics of the research projects that received awards. Within the broad domains of learning/learning environments, workforce development, and broadening participation identified in the program solicitation, the COV review of jackets revealed that a large proportion of the awards have learning/learning environments as their primary focus with proportionately fewer awards (and applications) with a clear and primary focus on fundamental research questions related to workforce development and broadening participation, or topics that overlap these areas.</p> <p>In addition, the COV believes there are a number of topics that have not been well developed in the current portfolio but are nonetheless of especial relevance to the knowledge base necessary to understand key aspects of STEM learning, workforce development, and participation in ways that would support effective policy and practice. Workforce demand for STEM skills below the Ph.D. level and its implications for broadening participation might be one example. These deficiencies are best addressed with sustained programmatic strands of research aimed at developing a coherent and informative knowledge base around selected high priority topics. While the ECR research portfolio does and will certainly include research on some of these topics, relying on whatever relevant research proposals happen to be submitted is unlikely to yield the coverage or the steady programmatic progress needed. The COV believes it would enhance the contributions the ECR program can make to the mission of the EHR directorate to identify such high priority topics and proactively solicit research proposals that address them.</p>	<p style="text-align: center;">NOT APPROPRIATE</p>

COV Recommendations:

Explore ways to broaden the disciplinary diversity of the pool of PIs and to stimulate proposals for fundamental research on workforce development and broadening participation. Options to consider might include, for example, expanded text in the solicitation that encourages such proposals, targeted Dear Colleague Letters, and outreach to professional associations for underrepresented disciplines.

Identify underdeveloped high priority topics for which programmatic research is needed and find ways to encourage proposals that address those topics without compromising the openness of the ECR program to other topics as well. The following suggestions for identifying such high priority topics might be considered:

1. Task the EHR Advisory Committee with nominating high priority fundamental research questions in each of the areas of STEM learning/learning environments, workforce development, and broadening participation.
2. Conduct workshops and listening sessions at national forums for relevant STEM researchers, policy makers, or practitioners to solicit their opinions about critical fundamental research areas in which a greater depth of knowledge is needed.
3. Periodically convene discussion groups comprised of EHR POs and other pertinent staff members to reflect upon their experience with their respective EHR programs and the knowledge domains in which greater depth is needed to effectively accomplish the goals of those programs and the overall EHR mission.

The following suggestions for encouraging submission of proposals that help build programmatic strands of research around the identified high priority topics might be considered:

1. Delineation of those strands in the solicitation in a section that identifies them as areas of particular interest to the ECR program. It would be important to make clear in the overall solicitation that those priorities are not intended to discourage proposals on other topics that fit the eligibility criteria for the ECR program.
2. For each such strand, include additional encouragement for proposals that integrate and synthesize current research with particular attention to identifying gaps and highlighting the cutting edge where further research is most needed. Such synthesis products are not only themselves an important contribution to research in high priority areas, but can be cited in the ECR solicitations as background to help interested researchers target their proposals to research questions of particular relevance to moving a priority research strand forward.
3. Promote the priority research strands generally when possible and appropriate at relevant professional conferences for researchers, via the NSF and EHR communication network and the like. Use targeted Dear Colleague Letters to highlight specific topics and questions within a research strand to which attention is especially needed to move that strand forward.

Data Source: EIS/Committee of Visitors Module. From the Report View drop-down, select the Funding Rate module to see counts of proposals

<p>and awards for programs. The Proposal Count by Type Report View will also provide a summary of proposals by program.</p>	
<p>2. Are awards appropriate in size and duration for the scope of the projects?</p> <p>Comments:</p> <p>The COV examined the quartile distributions and clustering of the monetary value of the FY13-15 ECR awards. The funded grant amounts indicate that the PIs were responsive to the allowable funding limits, as indicated in the solicitation by the tier levels of funding. Overall, however, the available data do not enable the COV to make a determination as to whether these funding amounts and the associated study durations are appropriate to program goals. COV discussion noted that proposal reviewers did on occasion raise issues with budget and staffing levels that they felt were inadequate to achieve the stated research goals within the specified funding period. This indicates the review process was attentive to questions concerning appropriateness of funding, duration, and study goals.</p> <p>The COV noted that the breakdown of the different levels of available funding amounts in the solicitation does not indicate what types of studies are presumed to most appropriately fall within each level. PIs are thus able to position themselves in a specific level of funding regardless of the actual type of research. The COV members found this puzzling—if any kind of study can be proposed at any funding level up to the maximum allowable, there is no apparent reason for specifying funding levels. As more experience is gained in the ECR program about the nature of the proposals submitted and the types of studies desired, it may be worthwhile to revisit the tier funding amounts and allowable study durations and consider providing more guidance to applicants about the categories appropriate for different types of projects.</p> <p>Data Source: EIS/Committee of Visitors Module. From the Report View drop-down, select Average Award Size and Duration.</p>	<p>APPROPRIATE</p>
<p>3. Does the program portfolio include awards for projects that are innovative or potentially transformative?</p> <p>Comments:</p> <p>There are many conceptualizations of “innovation” and “transformation” and vigorous debates about the appropriate criteria for recognizing research that would properly be described as such. A simple approach is to expect that some of the research conducted in the ECR program will provide useful new ways of thinking about, and addressing pressing issues in STEM education and human resources. The proposals reviewed by the COV offer examples of research based on concepts that are relatively novel for application to STEM issues. Examples that garnered enthusiasm among reviewers and program officers include extensions of the concept of stereotype threat (e.g., social contagion of stereotype threat) and empirical tests of the principles of culturally responsive pedagogy.</p>	<p>APPROPRIATE</p>

<p>However, the COV also observed that some innovative ideas seemed to fare poorly during the review process because of a mismatch between the ECR aspirational goals of supporting innovative and transformative research and reviewers' interpretations of how the Intellectual Merit and Broader Impacts criteria should be applied. For example, some reviewers focused on the immediate potential for practical application as a key element of broader impact rather than assessing the implications for stimulating new lines of research or the ability of dissemination plans to introduce potentially useful novel concepts into discourse on STEM issues.</p> <p>Without compromising these unifying standards for NSF reviews, panels might receive instruction from POs concerning the different ways proposals can demonstrate intellectual merit and broader impacts that are appropriate to the nature and goals of the ECR program. Further, applicants might be encouraged to give particular attention to highlighting how their proposals relate to areas of intellectual excitement in their field and take especial care to emphasize any innovative or transformative ideas or applications of ideas those proposals offer.</p> <p>Data Source: Jackets</p>	
<p>4. Does the program portfolio include inter- and multi-disciplinary projects?</p> <p>Comments:</p> <p>The data available to the COV shows 47 FY13-15 ECR awards funded by other NSF units, though these include multiple awards for collaborative projects. Similarly, the available data shows 87 awards made in other NSF units that ECR funded, many of which are also multiple awards for the same collaborative project. Relative to the 140 awards made in FY13-15, these data show a relatively high proportion of co-funding across units for projects that, therefore, might be assumed to be inter- or multi-disciplinary.</p> <p>Though no specific data were available to the COV that identified the disciplines of the members of the research teams involved in the applications to the ECR program, a review of the jackets revealed many instances of multidisciplinary teams.</p> <p>Data Source: If co-funding is a desired proxy for measuring inter- and multi-disciplinary projects, the Co-Funding from Contributing Orgs and Co-Funding Contributed to Recipient Orgs reports can be obtained using the EIS/Committee of Visitors Module. They are available as selections on the Report View drop-down.</p>	<p>APPROPRIATE</p>
<p>5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators?</p> <p>Comments:</p> <p>It is difficult to judge the appropriateness of the geographical distribution of Principal Investigators without any standard with which to compare. Over the three years under review, proposals were received from all 50 states and the</p>	<p>APPROPRIATE</p>

<p>District of Columbia. PIs from 24 states received awards. Among states from which 10 or more proposals were received, the highest win rates were for D.C. (27%), PA (25%), and IN (23%). The lowest win rates among frequently proposing states were for HI, KY, and NJ (all zero). Only 1 of the 26 proposals submitted from Georgia was funded and only 2 of the 63 proposals from Texas.</p> <p>These data thus indicate a rather uneven geographical distribution of home states for ECR applicants. However, the COV notes that the ECR program is a merit-based competition and, as such, it is not apparent that considerations of geographical distribution are especially relevant, assuming merit is judged fairly and objectively. On the other hand, the great disparities in funding rates across states are troubling and warrant a more thorough effort than the COV is able to undertake to investigate the reasons for these disparities and what might be appropriately done to reduce them. It is relevant in this regard to note that among the goals of the NSF-wide Experimental Program to Stimulate Competitive Research (EPSCoR) is capacity building in regions of the country that are less able to compete successfully for research funds.</p> <p>Data Source: EIS/Committee of Visitors Module. Select Proposals by State from the Report View drop-down.</p>	
<p>6. Does the program portfolio have an appropriate balance of awards to different types of institutions?</p> <p>Comments:</p> <p>Again, in the absence of any policy or standard, it is difficult to say whether the award distribution is appropriate. Significant numbers of proposals were received from academic institutions (693), nonprofit research organizations (88), and small businesses (50). Among these, the win rates were 16% for academic institutions, 20% for nonprofits, and 14% for small businesses. A handful of proposals were received from academic system offices, large businesses, and an FFRDC.</p> <p>The COV compared the ECR institutional distribution of awards for FY13-15 with the distribution for all DRL programs during FY11-14 and found them to be substantially similar. The COV noted that HBCUs, minority serving institutions generally, and Hispanic serving institutions were not identified in the Data Sources indicated below for this item (see further comments in Item 9).</p> <p>Data Source: EIS/Committee of Visitors Module. Select Proposals by Institution Type from the Report View drop-down. Also, the Obligations by Institution Type will provide information on the funding to institutions by type.</p>	<p>DATA NOT AVAILABLE</p>
<p>7. Does the program portfolio have an appropriate balance of awards to new and early-career investigators?</p>	<p>NOT APPROPRIATE</p>

<p>[NOTE: A new investigator is an individual who has not served as the PI or Co-PI on any award from NSF (with the exception of doctoral dissertation awards, graduate or post-doctoral fellowships, research planning grants, or conferences, symposia and workshop grants.) An early-career investigator is defined as someone within seven years of receiving his or her last degree at the time of the award.]</p> <p>Comments:</p> <p>The COV did not have data on the proportion of all the proposals submitted that were from new or early career investigators, so it was not possible to assess how well represented applicants in these categories were in the total pool of proposals considered for funding. However, the data that were available indicated that, of those new and early career PIs who submitted proposals, the funding rate was 2% in 2013, 1% in 2014, and 4% in 2015. These percentages contrast sharply with the overall funding rate for all proposals, which averaged 17% over this period.</p> <p>It is to be expected that the success rate for proposals from new and early career PIs will be lower than that for more experienced researchers, but the strikingly low rates for those PIs is problematic. It is important for the continuing vitality of the ECR program that less experienced PIs have a reasonable chance of receiving funding and the associated opportunities to gain experience and establish a track record of funded research.</p> <p><u>COV Recommendation:</u></p> <p>The COV recognizes that ECR POs and EHR administrators are aware of this situation and are making efforts to address it. Proactive capacity-building efforts aimed at supporting less experienced researchers are called for using whatever means EHR is able to employ. In particular, the COV believes that consideration should be given to creating a distinct category for proposals from new and early career PIs within the ECR funding framework, e.g., for small grants and exploratory research, that would be reviewed separately with attention to encouraging the most promising researchers and lines of research.</p> <p>Data Source: EIS/Committee of Visitors Module. Select Funding Rate from the Report View drop-down. After this report is run, use the Category Filter button to select New PI for the PI Status filter or New Involvement (PIs & coPIs) = Yes.</p>	
<p>8. Does the program portfolio include projects that integrate research and education?</p> <p>Comments:</p> <p>By their very nature, all of the ECR projects integrate research and education.</p> <p>Data Source: Jackets</p>	<p>APPROPRIATE</p>

<p>9. Does the program portfolio have appropriate participation of underrepresented groups²?</p> <p>Comments:</p> <p>Reviewers play an important role in shaping the portfolio; the COV therefore first considered the diversity of the reviewer pool. However, the data available to the COV indicated that racial and ethnic identification was not known for 86% of the reviewers. Clearly those data are insufficient to support any conclusions about the participation of underrepresented groups among ECR reviewers.</p> <p>Among ECR awards, the sparse identifying data in the All Awards data file the COV reviewed showed no underrepresented minority PIs in the lower half of the funding distribution, four in the third quartile, and three in the top quartile (including PIs and co-PIs on collaborative proposals as separate grantees). It appears that one HBCU was funded (in the second quartile of the funding level). Other data provided to the COV indicated that 65-66% of ECR proposals had “women involvement” and 19-22% had “minority involvement,” which we understand refers to PIs and co-PIs only. For the proposals that received awards during FY13-15, the data provided to the COV showed that 62-70% had “women involvement” and 8-26% had “minority involvement.”</p> <p>These figures compare to 61-66% “women involvement” and 16-17% “minority involvement” for all DRL proposals, and 62-68% “women involvement” and 12-19% “minority involvement” for all DRL awards during FY11-14. These comparisons suggest that women and minority involvement in ECR proposals and awards is substantially similar to that typical of the DRL portfolio and thus not distinctively higher or lower. The COV was not able to compare these figures with benchmarks for the proportion of women and minority researchers working in the U.S. in disciplines relevant to ECR. The extent to which there was full representativeness, therefore, could not be assessed, especially for minority involvement given the high proportions of women involvement.</p> <p><u>COV Recommendations:</u></p> <p>The COV are aware that the information required to assess participation of various sorts by underrepresented groups is self-reported and therefore voluntary (and some potential respondents may have principled objections to reporting such information). Nonetheless, it seems likely that a greater response rate could be attained if requests were routinely and consistently made, and done so with an explanation of the importance of that information for tracking progress toward the NSF broadening participation goals. For example, the on-line system could issue a second prompt highlighting the importance of this information to NSF diversity goals before enabling users entering or updating their profiles to move to the next screen. And, the</p>	<p>DATA NOT AVAILABLE</p>
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² NSF does not have the legal authority to require principal investigators or reviewers to provide demographic data. Since provision of such data is voluntary, the demographic data available are incomplete. This may make it difficult to answer this question for small programs. However, experience suggests that even with the limited data available, COVs are able to provide a meaningful response to this question for most programs.

<p>distribution and collection of paper forms at panel meetings could be regularly preceded by a statement from the POs emphasizing the value of complete demographic data to NSF broadening participation goals.</p> <p>With regard to the information made available to a COV, it would be helpful for assessing the breadth of participation to have a detailed definition of the term “involvement” that is used in the reports provided to the COV. In addition, to the extent possible, it would be useful to have a more fine-grained breakdown of the relevant demographic data for the individuals with different roles in ECR, e.g., reviewers, PIs and Co-PIs, other project personnel, consultants and advisory board members, etc. Further, it would be informative to have the data about applicant teams reported separately for funded and declined proposals. To provide some basis for comparison, at least within EHR, having comparable data for the most relevant divisions would also be helpful (for this report, the COV has assumed that DRL is the division with the most similar funding programs). The COV members are aware that complete and fine-grained data of the sort desired are not generally available, but also recognize that more detail could be provided for what is available (and, as indicated in the recommendation above, it may be possible to improve response rates).</p> <p>Data Source: EIS/Committee of Visitors Module. Select Funding Rate from the Report View drop-down. After this report is run, use the Category Filter button to select Women Involvement = Yes or Minority Involvement = Yes to apply the appropriate filters.</p>	
<p>10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports.</p> <p>Comments:</p> <p>Clearly, the foci of ECR are highly relevant to national and agency priorities as well as the interests of many NSF constituencies. Improving STEM learning opportunities, STEM workforce development, and broadening participation in STEM are topics that have had an unprecedented level of promotion at the national level during the last decade (see bibliography below). As one example, a February 2016 White House blog listed the following actions under the Obama Administration to “create an all-hands-on-deck approach to science, technology, engineering, and math:”</p> <ul style="list-style-type: none"> • \$1 billion in private investment for improving STEM education as part of the President’s Educate to Innovate (https://www.whitehouse.gov/issues/education/k-12/educate-innovate) campaign. • A goal set by the President in 2011 to prepare 100,000 new math and science teachers by 2021. • Incorporation of STEM education into the priorities of the Department of Education, as illustrated by the administration’s signature Race to the Top (https://www.whitehouse.gov/issues/education/k-12/race-to-the-top) competition. 	<p>APPROPRIATE</p>

- More than 350 commitments announced by the White House from college and university leadership and others to provide pathways for underrepresented students to attain STEM degrees.
- Initiation of the [White House Science Fair](https://www.whitehouse.gov/science-fair) (<https://www.whitehouse.gov/science-fair>) to honor young people using science, technology, engineering, and mathematics to improve their communities and the world.
- And in his [final budget](https://www.whitehouse.gov/blog/2016/02/09/president-obamas-2017-budget-innovating-better-future) (<https://www.whitehouse.gov/blog/2016/02/09/president-obamas-2017-budget-innovating-better-future>), the President asked for an investment of \$3.0 billion across 14 Federal agencies for dedicated STEM education programs.

On the Congressional front, the Every Student Succeeds Act (ESSA) of 2015 identifies STEM as a priority. It gives states more latitude in how they measure student progress, in particular allowing, though not requiring, inclusion of science assessments in their accountability systems (and more than half of the states appear to be interested in doing so). ESSA also permits states to set up STEM specialty schools designed to serve students from underrepresented groups and calls for a STEM Master Teacher Corps. The research the ECR program supports has the potential to help inform the design of the initiatives state and local decision makers undertake in response to these STEM themes in ESSA.

Within NSF, the ECR research foci are squarely aligned to the three overarching EHR themes (STEM learning and learning environments, workforce development, and broadening participation) as articulated in the 2014 report of the EHR Advisory Committee. More broadly, the ECR program seeks to build the kinds of fundamental knowledge needed by the recently announced Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES) initiative to enhance U.S. leadership in science and engineering discovery and innovation by proactively seeking and effectively developing STEM talent from all sectors and groups in our society.

Examples of reports and publications in the last decade focusing on STEM education and the STEM workforce:

- Advisory Committee for Education and Human Resources. (2014, May). *Strategic Re-envisioning for the Education and Human Resources Directorate. A Report to the Education and Human Resources Directorate.*
- Gamoran, A. (2016, September 16). Will latest U.S. law lead to successful schools in STEM? *Science*, 353(6305), 1209-1211.
- Kober, N. (2015). *Reaching Students: What Research Says About Effective Instruction in Undergraduate Science and Engineering.* Washington, DC: The National Academies Press.
- National Academy of Engineering. (2014). *Surmounting the Barriers: Ethnic Diversity in Engineering Education: Summary of a Workshop.* Washington, DC: National Academies Press.
- National Academy of Engineering. (2005). *Assessing the capacity of the U.S. engineering research enterprise.* Preliminary Report of the National Academy of Engineering Committee for Public View. <http://www.nae.edu/NAE/engecocom.nsf/weblinks/MKEZ-68HQMA?OpenDocument>
- National Academy of Sciences. (2016). *Barriers and opportunities for 2-Year and 4-Year STEM degrees: Systemic change to support students' diverse*

pathways. [<http://www.nap.edu/catalog/21739/barriers-and-opportunities-for-2-year-and-4-year-stem-degrees>]

- National Research Council. (2015). *Enhancing the Effectiveness of Team Science*. Committee on the Science of Team Science, N.J. Cooke and M.L. Hilton, Editors. Washington, DC: The National Academies Press.
- National Research Council. (2012). *Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering*. Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research. Washington, DC: The National Academies Press.
- National Research Council. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Committee on Defining Deeper Learning and 21st Century Skills, Board on Testing and Assessment and Board on Science Education. Washington, DC: The National Academies Press.
- National Science Board. (2006). *America's pressing challenge-Building a stronger foundation: A companion to science and engineering indicators-2006* (NSB-06-02). Arlington, VA: NSF.
- National Science Board. (2010). *Preparing the next generation of STEM innovators: Identifying and developing our national human capital*. Arlington, VA: NSF.
[<https://www.nsf.gov/nsb/publications/2010/nsb1033.pdf>]
- National Science and Technology Council. (2013). *5-Year federal science, technology, engineering, and mathematics (STEM) education strategic plan*.
[http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf]
- President's Council of Advisors on Science and Technology (PCAST). (2010). *Report to the President. Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future*. Washington D.C.: White House Office of Science and Technology Policy.

COV Recommendation:

As noted above in Question 1 of this Section, the COV felt that ECR should go beyond alignment with these national and agency themes to identify and address gaps in the knowledge base and high priority research questions from the perspective of the fundamental understanding of STEM learning, workforce development, and participation that should undergird policy and practice in those domains. In particular, ECR should be developing a fundamental knowledge base that all EHR divisions can call on as they shape their programs and portfolios. For example, fundamental research on the development of resilience among college students from groups underrepresented in STEM fields should inform the design and evaluation of programs aimed at broadening participation. Behavioral economic models of the decision processes and economic consequences of persistence and non-persistence in STEM pathways for students from lower-income backgrounds could similarly inform graduate education and fellowship programs.

Data Source: Jackets

11. Additional comments on the quality of the projects or the balance of the portfolio:

The COV made the following observations about the ECR portfolio and its coverage of research topics based on the sample of jackets examined:

The research related to the STEM workforce seems to skew heavily toward supply side issues (skill development, retention, increasing participation, etc.). Almost nothing was found that examines the interface with employers and other dimensions of the demand side for human resources in STEM. However, there are economic, sociological, and cultural dimensions associated with the demand for STEM workers that are of enormous importance for society.

Moreover, the projects related to workforce development seemed to focus mainly on the undergraduate to graduate transition. Transitions from one job to another in the workforce were rarely addressed.

Relatively few of the studies proposed focused on museums and other informal STEM learning environments, or on community colleges and other such learning environments outside of 4-year university undergraduate and graduate programs.

Some of the proposals for ECR funding, including ones that received awards, seemed more appropriate for submission to other EHR programs; e.g., projects to evaluate the effects of K-12 STEM educational interventions that appeared to be appropriate for the DRK-12 program.

OTHER TOPICS

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

No additional comments.

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

No additional comments.

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

ECR is a new program that aspires to support fundamental research on topics relevant to the mission of the EHR Directorate. In this regard, it is similar to the core research programs in other NSF directorates, but also distinctively different because of the unique EHR mission. While the COV members have not raised any NSF-level issues in this review that they feel need to be addressed, they do want to highlight the central and essential role of this new program in EHR, and for STEM education and human resources generally, and encourage agency-wide efforts to support and nurture it as it develops and expands.

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

No additional comments.

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

Recognizing that concerns raised by the COV in this regard are likely to be distinctive to this particular COV and the ECR program reviewed, the following suggestions are offered:

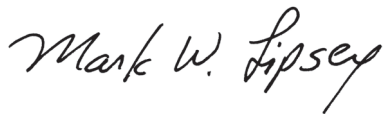
While the COV greatly appreciated the data tables and related documents made available for the ECR review, more support was needed to enable the members to properly understand and interpret these materials. In particular, it would have been very helpful, and relatively easy to accomplish, if the various spreadsheet data summaries had included definitions of the categories and column headings around which those summaries were structured, many of which were rather cryptic abbreviations.

The COV members were given access to the ECR jackets, including the sample drawn for closer inspection, rather too close to the time of the COV meeting to be able to fully explore the information they provided in advance of that meeting.

While the COV understands the reasons that the template is quite generic given that it is widely used at NSF, that generality did create occasional difficulty for the COV. For items that did not align well with the nature of the ECR program, for instance, there was no easy basis for deciding whether to simply respond “not applicable” or to attempt to address the issue in the necessarily constrained way possible. As one example, the item about whether the geographical distribution of PIs is appropriate provides no indication of the criteria by which “appropriate” might be judged, or expected, for a program like ECR and yet the COV did recognize that it was not entirely irrelevant as an aspect of the NSF broadening participation goals.

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SIGNATURE BLOCK:



For the EHR Core Research (ECR) Program COV

Dr. Mark Lipsey
Chair