TO: Dr. Willie Pearson, Jr., DRL/HRD Bundled COV Chair
FROM: Dr. Ron Marx, DR K-12 COV Co-Chair
RE: DR K-12 COV Report

Executive Summary

The DR K-12 COV is pleased to submit its report for the 2009-2011 review period. The COV was impressed with the role that DR K-12 plays in funding innovative research in STEM education. The number of grant applications grew substantially over the period, and by-and-large, the COV believes that the grant review process and results reflect high levels of quality and integrity. The COV is concerned, however, that the increasing workflow for the program staff is substantial. Recommendations in the COV report reflect the COV's opinion that quality must be ensured. The COV urges that NSF consider how to fund the full range of R&D efforts in DR K-12 that can better move the field toward cumulative science of STEM teaching and learning.

Selected Findings

The DR K-12 COV reviewed a large quantity of data and supporting materials for the DR K-12 Program over the 2009-2011 time period. The program has done an admirable job of managing a large and growing workload; the COV feels that the proposals which receive awards are deserving of them. A few concerns/recommendations from the 2009 COV report continue to be of concern to the 2012 COV, such as the geographic distribution of awards and the number of awards focused on teacher preparation.

Recommendations

The DR K-12 COV provided the following key recommendations for consideration:

- The COV recommends having K-12 practitioners as reviewers in the panel to help address the varying interpretations of Broader Impacts by panelists.
- The COV recommends providing suggestions for improving proposals that are competitive but could not be funded. This would be beneficial to PIs.
- DR K-12 should work to increase the representation of varied expertise among reviewers on panels to ensure that all proposals are reviewed by experts in the STEM content of the proposal.
- DR K-12 should raise the expected percentage of participation of individuals from underrepresented groups on panels. Additionally, the COV encourages increased support/encouragement for applicants in rural communities.
- The COV suggests that the program promote DR K-12 projects' best practices in dissemination no only within the research community, but also within communities of practice to increase broader impacts.
- The COV recommends that DRL staff set goals for combined DR K-12 and REESE portfolio to ensure adequate attention to all parts of the Cycle. Special attention should be given to encouraging proposals that fit the "Implement" and "Scale Up" stages.
- The COV encourages DR K-12 to continue considering innovative ways they might encourage teacher-preparation and teach-support programs to develop and submit

proposals that will support new teachers as they transition from pre-service through their early careers.

- The COV recommends more attention to compiling consistent and well-documented data on the portfolio for future COVs and in support of management's decision-making.

CORE QUESTIONS and REPORT TEMPLATE
for
FY 2012 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to NSF Staff: This document includes the FY 2012 set of Core Questions and the COV Report Template for use by NSF staff when preparing and conducting COVs during FY 2012. Specific guidance for NSF staff describing the COV review process is described in Subchapter 300-Committee of Visitors Reviews (NSF Manual 1, Section VIII) that can be obtained at <www.inside.nsf.gov/od/oia/cov>.

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Committee of Visitor (COV) reviews provide NSF with external expert judgments in two areas: (1) assessments of the quality and integrity of program operations and program-level technical and (2) managerial matters pertaining to proposal decisions.

The program(s) under review may include several sub-activities as well as NSF-wide activities. The directorate or division may instruct the COV to provide answers addressing a cluster or group of programs – a portfolio of activities integrated as a whole – or to provide answers specific to the sub-activities of the program, with the latter requiring more time but providing more detailed information.

The Division or Directorate may choose to add questions relevant to the activities under review. NSF staff should work with the COV members in advance of the meeting to provide them with the report template, organized background materials, and to identify questions/goals that apply to the program(s) under review.

Suggested sources of information for COVs to consider are provided for each item. As indicated, a resource for NSF staff preparing data for COVs is the Enterprise Information System (EIS) –Web COV module, which can be accessed by NSF staff only at http://budg-eis-01/eisportal/default.aspx. In addition, NSF staff preparing for the COV should consider other sources of information, as appropriate for the programs under review.

For section IV addressing portfolio balance the program should provide the COV with a statement of the program's portfolio goals and ask specific questions about the program under review. Some suggestions regarding portfolio dimensions are given on the template. These suggestions will not be appropriate for all programs.

Guidance to the COV: The COV report should provide a balanced assessment of NSF's performance in the integrity and efficiency of the ***processes*** related to proposal review. Discussions leading to answers for Part A of the Core Questions will require study of confidential material such as declined proposals and reviewer comments. ***COV reports should not contain confidential material or specific information about declined proposals.*** The reports generated by COVs are made available to the public.

We encourage COV members to provide comments to NSF on how to improve in all areas, as well as suggestions for the COV process, format, and questions. For past COV reports, please see http://www.nsf.gov/od/oia/activities/cov/covs.jsp.

FY 2012 REPORT TEMPLATE FOR
NSF COMMITTEES OF VISITORS (COVs)
Discovery Research K-12 (DR K-12)

The table below should be completed by program staff.

Date of COV: September 19-21, 2012
Program/Cluster/Section: Discovery Research K-12 (DRK-12)
Division: Division on Research on Learning (DRL)
Directorate: Education and Human Resources (EHR)
Number of actions reviewed: 146 **Awards: 32** **Declinations: 114** **Other:**
Total number of actions within Program/Cluster/Division during period under review: 1650 **Awards: 221** **Declinations: 1287** **Other: 142**
Manner in which reviewed actions were selected: All awards ending in "7" and all declines ending in "7" excepting "67" and "77." The total number of items on the random list was 113. In addition, staff added 12 awards, including the CADRE Network award. The list of additional awards was provided to the COV on the web page.

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, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program 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**
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: Considering the number of proposals reviewed, the process worked well. The COV found there was appropriate correspondence including well-articulated panel reviews and summaries; the COV noted that there were no panel reviews for proposals which received low ratings. The reason for this should be made clear to the next COV before they begin the review process. The COV should be made aware of what is communicated to Principal Investigators (PIs) in cases where no panel reviews are provided. The COV noted that PIs were periodically given additional opportunities to respond to questions raised during panel discussions; some of these proposals were ultimately funded. Potentially transformative proposals are occasionally given the opportunity to further explain/answer questions even if rated lower than other similarly rated proposals. The COV encourages the NSF to continue this approach. **Data Source: EIS/Type of Review Module**	YES
2. Are both merit review criteria addressed a) In individual reviews? b) In panel summaries?	YES

c) In Program Officer review analyses? Comments: The DR K-12 panel review process addressed the Intellectual Merit (IM) and Broader Impacts (BI) review criteria across the three levels. Individual reviews varied in the depth and extent of comments. In some cases, brief (sometimes one sentence) statements were provided for IM and BI. The COV noted that panel members responded in more depth to the intellectual merits of proposals as compared to the broader impacts. Broader impact as a criterion is often interpreted differently among reviewers and panelists. For example, broader impact was addressed by some as impact for students whereas others addressed broader impact with regard to theory and dissemination of research findings. • **COV Recommendations:** o The COV recommends having K-12 practitioners as reviewers on the panel to help address this issue. o Training via webinars for reviewers and solicitations to further explain the BI criteria may help to address this issue while still maintaining consistency with the broadly applicable merit review criteria for NSF. The COV noted that the Program Officers' (POs) review analyses consistently addressed both the IM and BI and summarized key information from panelist discussions. **Data Source: Jackets**	
3. Do the individual reviewers provide substantive comments to explain their assessment of the proposals? Comments: The COV noted while most reviewers provided substantive comments to explain their assessment of the proposals, not all comments provided suggestions for PIs of declined proposals to increase the likelihood of funding when revising/submitting new proposals. Further, some of the responses were short and ambiguous. The COV also noted that although individual reviewers may focus on a particular aspect of a proposal more than others, these individual reviews/perspectives are brought together in the panels to ensure that all important issues are usually addressed. **Data Source: Jackets**	YES
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments:	YES

Generally, the panel summaries provided the rationale for the panel consensus. There were some inconsistencies in panel summaries, but there was always an analysis of the discussion. • **COV Recommendation:** The COV recommends adding explanations in panel summaries when panel discussions of proposals do not occur. Some additional preparation of reviewers is important to provide strong reviews and panel summaries. This may include providing samples and/or rubrics of well-written panel summaries to set a standard of what is important to include in a panel summary as well as the kinds of comments that should not be included in the reviews and panel summaries. **Data Source: Jackets**	
5. Does the documentation in the jacket provide the rationale for the award/decline decision? (Note: Documentation in jacket usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.) Comments: The documentation in the jacket provides the rationale for the award/decline decision. Documentation in jackets included a context statement, individual reviews, panel summary (if applicable), PO review analysis, email communications, and staff diary notes. The COV also noted that, with regard to highly rated proposals, personal communication from the PO to the PI reflected careful communication for clarification and resolution of concerns/issues related to panelist discussions. **Data Source: Jackets**	YES
6. Does the documentation to PI provide the rationale for the award/decline decision? (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 or telephoned with diary note in jacket) of the basis for a declination.) Comments: The documentation pertaining to the rationales for awards and declines were generally well-recorded and provided to PIs. The COV noted that not all responses to PIs of declined proposals included suggestions pertaining to improving proposals for resubmission. • **COV Recommendation:** The COV recommends providing suggestions for	YES

improving proposals that are competitive but could not be funded. This would be beneficial to the PIs. The COV noted a lack of depth in the analysis of individual reviews and panel summaries for proposals which were deemed poor by the reviewers/panels. POs, for the most part, provided review analyses and comments that filled in any gaps that may have been present from the individual reviews and panel summaries. The COV noted the POs gave a clear and comprehensive rationale when they declined proposals that had been rated highly by panelists. **Data Source: Jackets**	
7. Additional comments on the quality and effectiveness of the program's use of merit review process: The COV noted that while most panels paid close attention to the expertise of the panelists, we remain concerned that there is periodically not sufficient engagement of reviewers with subject matter expertise, such as K-12 mathematics teachers, mathematics teacher educators, and mathematicians to ensure the quality of review with regard to the application of the subject matter. The COV recognizes that there is a large amount of work for POs and reviewers in sorting through submissions. This large workload may affect the quality of the review process.	

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**
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The COV finds that the panels are generally comprised of reviewers with appropriate expertise and qualifications. We noted a few concerns: • There is a concern that some of the proposals maybe reviewed without attention to content correctness. Thus, there maybe times when the decision is "fragile."	DATA NOT AVAILABLE

The lack of attention to content correctness may be due to an imbalance of discipline expertise represented on panels, etc. (math, science, engineering, and technology as well as appropriate breadth of sub-disciplines). o **COV Recommendation:** DR K-12 should work to increase the representation of varied expertise among reviewers on panels to ensure that all proposals are reviewed by experts in the STEM content of the proposal. • As stated in the 2009 COV report, K-12 educators/specialists tend to be underrepresented as reviewers. There are some complexities in getting these reviewers on panels, and attention should be paid by NSF to the appropriate ways to get these specialists on panels. For example, NSF can draw from participants in MSP, Noyce Master Teacher projects, and Presidential Awardees. It may prove beneficial for NSF PO to attend meetings with school, district, and state level administrators, such as Association of State Supervisors of Mathematics, American Association of School Administrators, Association for Supervision and Curriculum Development, Chief Council of State School Officers, National Council of Teachers of Mathematics, and National Science Teachers Association as a way to further broaden the pool of potential K-12 educators/specialists as panelists. o **COV Recommendation:** The COV suggests that practitioners/administrators who are instructional leaders are added to panels. • The COV wonders if there is an intentional recruitment plan for underrepresented groups to serve as reviewers on panels. Reviewers from HBCUs and MSIs are not always effectively represented on panels. o **COV Recommendation:** DR K-12 should raise the expected percentage of participation of individuals from underrepresented groups. Additionally, the COV encourages increased support/encouragement for applicants in rural communities. o **COV Recommendation:** DR K-12 should develop an explicit recruitment plan for individuals from underrepresented groups to serve as reviewers on panels. o **COV Recommendation:** DR K-12 should develop an explicit recruitment plan for reviewers from HBCUs and MSIs to serve on panels. • The COV applauds the creation of the matrix of panelist information, however, there are no data reported that specifically addresses the content expertise of a particular panel. Information about the reviewers is aggregated. A few COV members had some familiarity with some reviewers and a basic understanding of their expertise, but this was not always the case. • The lack of a formalized panel information matrix presented the most significant gap in the data provided to the COV. It would be beneficial to utilize this matrix in a more formal way for future COVs and for gathering important program information. **Data Source: Jackets**	
2. Did the program recognize and resolve conflicts of interest when appropriate?	YES

Comments: Yes, based on the review of the documentation provided in the jackets. The Program Directors responded according to the guidelines for handling conflicts of interests (COI). The COV appreciates that there are multiple COI checkpoints. The COV notes that a tension exists between the opportunity to have expert panelists from various fields who are well connected to the research community review proposals while also abiding by stringent COI policies. **Data Source: Jackets**	
Additional comments on reviewer selection:	

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 DR K-12 Program has done an admirable job of managing a large and growing workload. They have successfully risen to the twin challenges of an increase in the volume of proposals and a decrease in funds for awards. The COV feels that the program is managed equitably in that the proposals which receive awards are deserving of them. The COV saw evidence that POs work hard to ensure that taxpayer monies are invested wisely. Documentation from awarded projects shows that POs pose important questions during award negotiations and offer appropriate guidance during project implementation. Documentation also shows that as projects encountered real-world challenges, POs helped PIs explore and implement appropriate modifications to their plans. The COV also acknowledges that DR K-12 is doing a good job meeting the dwell rate for proposals. **<u>COV Recommendations/Suggestions</u>**: • The COV noted that some areas of PO expertise may be missing from the program. Specifically, expertise in mathematics content and science education were not readily apparent in the range of current POs. Recruitment efforts may need to focus on particular backgrounds/expertise. • The 2010 projections for the number of proposals was only 2/3 of the total number submitted the previous year. More realistic projections could reduce stress on program staff by giving them accurate targets for the number and expertise of reviewers needed to complete proposal reviews. • The COV did not see much evidence that findings from DR K-12 projects are broadly disseminated. o The COV suggests that the program promote best practices in dissemination not only within the research community, but also within communities of practice to increase broader impacts.

- The COV also suggests that data be provided to future COVs documenting how projects disseminate their lessons learned.
- The COV encourages NSF to seek ways to document the value that PI meetings may add to the program for building a community of practice and to consider other opportunities for having members of the community share their views and expertise.

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

Comments:

The solicitation encourages proposals that address immediate needs as well as emerging challenges and makes it clear that high-risk ideas are welcome. The COV also noted that POs have given serious consideration to out-of-the-box (but worthy) proposals that may not have fared well in panel reviews by seeking additional input from other POs and *ad hoc* reviews.

The COV recognizes that the focus on research has improved the DR K-12 Program, but in order to effect improvement in actual classrooms, the program might reconsider the balance between research that explores fundamental issues and the boundaries of inquiry and research that can lead to effective implementation projects. Projects need to find ways to assure that the focus of the research is grounded in the realities and challenges of students in today's classrooms.

The COV has the opinion that the body of proposals submitted to the program falls a bit short of addressing the overall goals of DR K-12 as well as it might. The COV perceived that increasing the percentage of awards made to synthesis and scale-up projects could address this issue. Members of the COV suggested that NSF consider a slightly different funding structure that could facilitate promotion of projects from exploratory phases all the way to scale up over a longer time period than the typical three-year cycle. For example, after identifying successful exploratory projects, POs might offer some incentive to project leadership to move the project to the scale-up phase.

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

Comments:

The COV saw evidence that DR K-12 POs have a process in place to review and update the program foci. Regular updates to the solicitation provide further evidence that NSF takes measures to keep the program relevant.

It was clear that POs work to assure an appropriate balance of awards among the strands, though the number of proposals submitted to each strand also seems to have some effect on the final portfolio. The COV's insight into the planning processes that guided development of the portfolio was obtained mostly through verbal interaction with a single Program Officer during the COV meeting.

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

Comments:

The COV saw clear evidence that NSF has thoughtfully considered questions and suggestions from the 2009 COV report and has responded to them within the limits of their resources.

Though NSF has promoted the DR K-12 Program among teacher education programs, the COV noted the relative lack of funded pre-service teacher projects as an ongoing issue. The COV encourages DR K-12 to continue considering innovative ways they might encourage teacher-preparation and teacher-support programs to develop and submit proposals that will support new teachers as they transition from pre-service through their early careers.

IV. Portfolio Review. Please provide comments on whether the program's portfolio goals are appropriate and whether the program has achieved its goals for portfolio balance.
Programs should provide materials to the COV regarding portfolio goals and can insert specific targeted questions about their portfolios. *(Some dimensions of portfolio balance to consider include: balance across disciplines and sub-disciplines, award size and duration, awards to new investigators, geographical distribution of awards, awards to different types of institutions, innovative/potentially transformative projects, projects with elements of risk, inter- and multi-disciplinary projects, projects that integrate research and education, and projects that are relevant to agency mission or national priorities).*

Comments:

Portfolio Goals

The COV was unable to find an explicit statement of the DR K-12 portfolio goals along most dimensions of interest in either the RFP or any of the other documents we reviewed. The RFP does specify an estimated number of awards of each proposal type: Exploratory, Research & Development (R&D), Conferences, & Workshops.

- **COV Recommendation:** The COV recommends articulating, and providing to future COV's, a more explicit statement about the desired portfolio balance along multiple dimensions. At the same time, a more explicit definition of what constitutes the "DR K-12 portfolio" would be helpful, resolving ambiguities such as whether to include awards that came in response to other solicitations.

The COV inferred additional dimensions of interest from the RFP, by the content of data tables and the COV template that were provided to the COV by program staff, and by discussion among the COV. Dimensions of portfolio balance that we consider to be of potential interest include:

- Proposal type: Exploratory, R&D, Conference, & Workshops
- Position in the cycle of research & development (2010 RFP page 5)
- Elementary/middle/high school (data table)
- DR K-12 strand: Assessment/ Learning/ Teaching/ Scale-up (RFP)
- Within Teaching strand, balance between pre-service and in-service
- DR K-12 Challenges (RFP)

- Content area (data table)
- Type of lead institution (data table)
- Prior-funded PI's versus new PI's (data table)
- Geographic distribution (COV template)
- Research approach: qualitative/quantitative; experimental/quasi-experimental (COV discussion)
- Sufficient number of (COV template):
    - Potentially transformative projects
    - Projects with risk
    - Inter- and multi-disciplinary projects
    - Projects that integrate research and education
    - Projects that are relevant to agency [NSF] mission or national priorities

While the COV was asked to comment on these dimensions, there were no data provided to give a basis for judging what the program's portfolio goals are with respect to these dimensions.

Portfolio Balance

As an overarching comment, the COV noted that the data we received relevant to portfolio balance was inconsistent, in a few cases drastically so. It could be that different years or different subsets of awards were shown in the various data sources provided to us, but whatever the reason, these discrepancies made the task of the COV more confusing. We tried to state which data source we used in our comments below, but in some cases our conclusions might differ depending on which data source we use.

- **COV Recommendation:** The COV recommends more attention to compiling consistent and well-documented data on the portfolio for future COVs and in support of management's decision-making.

Proposal type: Exploratory, R&D, Conference, & Workshops

With respect to proposal type, the expectation stated in the RFP does not match the outcomes across the three years (2009-2011) we examined. R&D proposals are far over represented among the funded grants relative to that anticipated in the RFP's. Rather than comprising approximately 1/3 of the awards as anticipated in the RFP's, the funded awards are more than ¾ full Research & Development. As full R&D awards are typically funded at a much higher dollar level than the other categories (except for Scale-up), the discrepancy in dollars between anticipated and awarded portfolio balance would be even more extreme. Thus the COV finds that NSF's enacted portfolio balance does not match its portfolio goals along this dimension. We believe that both Synthesis and Conference/Workshop activities are important in working towards the goal of having education research be a cumulative science that builds effectively on prior work rather than re-inventing wheels, and so we encourage DR K-12 to encourage and fund more of these relatively inexpensive but important projects.

	Exploratory	R & D	Synthesis	Scale-up	Conference & Workshop
Anticipated in 2009 solicitation	# 20-25	# 20-25	# 5-10	--	#5-10
Anticipated in 2010 solicitation	# 20-25	# 20-25	# 5-10	--	#5-10
Anticipated in 2011 solicitation	# 20-25	# 20-25	# 5-10	# 3-5	#5-10
% Awarded *	13.8%	81.4%	1.2%		2.4%

*Source: PowerPoint from the COV orientation

The COV also found another set of award-by-program data in the Westat draft portfolio analysis report (Table 3, page 9). Those figures are different than the figures displayed in the table above, with only 49.8% R&D. This discrepancy underscores the difficulty of resolving different data sets for the COV's work.

DR K-12 Strand: Assessment/ Learning/ Teaching/ Scale-up (RFP)

This is certainly a dimension of interest to the COV, but we received no data on this issue.

Within Teaching Strand, Balance between Pre-Service and In-Service

The 2009 COV report stated "The COV strongly recommends that DR K-12 aim to increase the number of awards … funding projects related to teacher preparation." Our COV agrees with that recommendation, feeling that it is more desirable to create good teachers from the beginning rather than to try to remediate them later through professional development. The balance in the awards examined in the Westat portfolio analysis was 108 in-service to 24 pre-service projects.

DR K-12 "Challenges"

The 2009 and 2010 RFPs included "Program Challenges," such as "How can improved assessment of student knowledge and skills advance preK-12 STEM teaching and learning?" Proposers tended to showcase what challenge they were responding to prominently in their proposal summaries and narratives. However, the COV did not find any data breaking down the portfolio according to challenges.

- Whatever sub-categories of work are prominent in an NSF RFP, those categories should be tracked in the data compiled for the COV and NSF leadership.

Position in the Cycle of Research and Development

Each DR K-12 solicitation has prominently displayed the Cycle of Research and Development and said, "All DRL programs are concerned with all five components of the cycle, to different degrees." The solicitation also says "DR K-12 projects focus on development and study of specific resources … while REESE projects focus primarily on building theory and knowledge." The NSF data the COV received categorized 73% of the grants awarded by DR K-12 as situated in the Design, Develop, and Test category with 15% in the Explore, Hypothesize, and Clarify stage of the Cycle and 13% in Implement, Study Efficacy, and Improve category. Only 3% of grants are in the Synthesize and Theorize stage and 7% in the Scale Up and Study Effectiveness stage (data adds to 111%). The COV is concerned that even with a different focus for REESE, the complete portfolio results in inadequate attention to part of the Cycle, especially the Implement, Study Efficacy, and Improve and Scale Up and Study Effectiveness stages.

- **<u>COV Recommendation</u>:** The COV recommends that DRL staff set goals for the combined DR K-12 and REESE portfolio so as to ensure adequate attention to all parts of the Cycle. Special attention should be given to encouraging proposals that fit the "Implement" and "Scale Up" stages.

Experience of PIs

Among projects funded directly through a DR K-12 solicitation from 2009-2011, 64% of PIs had received no prior NSF funding, and 50% of co-PIs had received no prior NSF funding. Another 14% of PIs and 23% of co-PIs had received funding from NSF but not from EHR programs. The remaining PIs and co-PIs had received prior EHR funding. This distribution indicates that the program is open to "new"

PIs without prior funding for educational work from NSF. The panel recognizes the tension between bringing new PIs and tapping into the experience of prior awardees, and is concerned that the percentage of new PIs may be, in fact, too high, especially in large grants. (Source: Westat tables, Table 8)

- **COV Recommendation:** The COV recommends that the program be careful that strong proposals by PIs and co-PIs with strong track records continue to be funded.

Table A-7. PIs and co-PIs: Prior NSF funding experiences for PIs

Prior NSF funding	DR K-12 solicitation	
	Yes (n=282)	No (n=170)
Received grant from DR K-12 Program	17.4%	14.7%
Received grant from predecessor program	25.5	30.0
Received grant from other EHR awards*	47.5	60.0
Received grant from other programs within NSF	23.8	31.2
Has not received any grants from NSF*	37.9	21.2

*Statistical significance at the 0.05 level between projects responding to DR K-12 solicitations and those responding to other solicitations

Minority Status of PI's

According to the EIS spreadsheet on PI demographics, African Americans have a low percentage of submissions (4.5% of submissions versus 13% of population), but once submitted, their proposals have a good award rate (14.9% African American funding rate versus 14.0% funding rate for all proposals). Asians and Unknowns have a worse award rate (10.6% and 9.3% respectively) than other ethnicity/origin groups.

Minority Status of Students and Teachers Served

The COV did not find data on the race or ethnicity of the participants served by DR K-12 awards. Although we recognize that such data could be difficult to obtain, it would be a very valuable data type to examine in tracking NSF's success in reaching populations that are underrepresented in STEM.

Distribution of Projects across Target Populations and Ages

According to the Westat draft portfolio evaluation of projects submitted in response to the DR K-12 solicitations in 2009-2011, a very large majority of projects specified K-12 teachers as a target population and fewer than 50% specified K-12 students as the target population (Table 10). The panel acknowledges the importance of developing capacity among teachers, but there is still much to be learned about effective teaching and learning processes. The COV encourages the program to consider whether the number of proposals targeting students should be increased, and expects that most large proposals that target teachers will also pay attention to student learning.

When both teachers and students are the target populations, the proportion of projects that targeted special education and English language learners and their teachers was small (special education: 0.7% of projects with teachers as a target population and 0.7% of projects with students as a target population; ELL: 0.7% of projects with teachers as a target population and 2.7% of projects with students as a target population). The proportion of projects focusing on low-performing schools and districts was also small (0.7% of projects focusing on teachers as a target population, 2.0% of projects with students as a target population).

The COV judges the mix of studies focused at different levels (pre-K, elementary, middle school, and high school) to be appropriate (Table 10).

- **COV Recommendation:** The COV recommends that the program encourage more proposals targeting special education students, ELL students, and students in low-performing schools, as well as the teachers of these groups of students, with the goal of funding more projects with these populations as a focus.

Award Duration

Data provided by NSF to the COV indicate that, during the period reviewed, the number of proposals received increased 78% in two years (from 365 to 650). The number of awards by year was 59, 73, and 57 and the size of grants awarded as measured by Average Annual Dollars grew 37% in two years (from $444K to $612K). This was accomplished, in part, by a decrease in award duration from 3.9 years to 3.3 years despite the fact that (for the 10-610 Solicitation) Full Research and Development and Scale Up projects could be for five years and $3.5M or $5M respectively. For the 11-588 Solicitation, which was used for the FY12 awards, the maximum length of awards was reduced to four years and the size of grants was limited to $3M and $4M respectively. The COV believes this is a shift in the wrong direction.

A challenge facing EHR in general, and DR K-12 in particular, is to contribute to education research becoming a cumulative enterprise that achieves the goal to, "significantly enhance the learning and teaching of STEM by preK-12 students, teachers, administrators, and parents." For this to happen, the field needs more research projects that reach successful conclusions that inform schools and districts across the nation. To achieve this with projects situated in the Implement, Study Efficacy, and Improve and Scale Up and Study Effectiveness stages of the Cycle, projects need to be longer (and larger), not shorter.

- **COV Recommendation:** The COV recommends that for the next solicitation there be an increase in possible award size and duration. Consider the idea of a five-year award duration where years four and five are contingent on a review after year three, similar to the STEP model.

Type of Lead Institution

NSF data regarding proposals by institution type indicate that proposals in the "Business, State & Local, Foreign, Other" are most successful (24%) while proposals from research intensive universities have only slightly higher success rates than the overall average (19% vs. 18%). Two-year, four-year, masters and other Ph.D. institutions have lower success. The COV does not find this outcome either surprising or concerning. We do recognize and commend NSF for efforts to encourage proposals from all types of institutions as part of an effort to diversify and expand the education research community. The COV does believe it would be useful for NSF to separate the "Business, State & Local, Foreign, Other" category into several categories so as to provide better information regarding the number of proposals and success rate of proposals from the K-12 community and education research corporations.

Distribution of Projects across Research Methodologies

The COV had data on 108 projects from 2009 to 2011 that had explicit research questions about product impact. The COV believes that the distribution of research across different methodologies in this subset of awards is appropriate, with more than 50% of the projects employing an experimental or quasi-experimental design. With the large proportion of projects that involve developing new instructional systems, the 32% of studies that employ pre-test/post-test designs is also appropriate. (Source: Data from Westat Draft Evaluation limited to the awards made between FY 2009 and FY 2011 that responded to DR K-12 solicitations, Table 15.) The COV could not determine whether sufficient attention is being paid to research methodologies that have the potential to reveal the processes and mechanisms that contribute to student learning, in contrast with gross comparisons of efficacy across treatments.

- **COV Recommendation:** The COV recommends that NSF compile information about portfolio balance with respect to research methods aimed at elucidating educational processes that contribute to efficacy. Projects that employ such methods should be encouraged.

Geographic Distribution

The 2009 COV report asserted that the geographical distribution of awards was not appropriately balanced in the DR K-12 portfolio, in part because there were 16 states where no institution had a DR K-12 award. The initial NSF response was that "the program is new." Now, three years further into the life of DR K-12, NSF data available to the COV indicate that for the three years reviewed by this COV (2009, 2010, and 2011), there were 17 states plus Puerto Rico where no institution received a DR K-12 award, another seven with only one award and six states with only two awards. That totals 31 "states" with only 19 awards between them. This includes a very large number of EPSCoR states and a very large number of rural states. The COV believes this is unacceptable.

The COV found a near absence of DR K-12 proposals with a focus on rural education. We note that we did not receive any data as to the number of DR K-12 proposals with a rural focus, but an informal poll of COV members indicated that no member of recalled a single proposal among the 146 reviewed by the COV having a rural focus.

Issues facing math and science education in schools located in towns and rural areas can differ from those in urban America in significant ways. This population includes large numbers of Hispanic students and a significant percentage of the Native American students in our country.

- **COV Recommendation:** DR K-12 should consider a research focus on STEM education in rural communities. In addition to making important contributions to enhancing math and science K-12 education in rural areas, a possible secondary benefit is that such an emphasis may encourage additional proposals from rural states including the 31 states that are most underrepresented in the DR K-12 portfolio.

Since the last COV report, efforts by NSF staff have contributed to an increase in the number of proposals from states that were identified as underrepresented in NSF's analysis of geographic diversity. However, there remain a large number of states, which together represent a substantial population and that contain many outstanding universities, where there are very few funded DR K-12 proposals.

- **COV Recommendation**: Given this information, NSF should consider providing additional support/capacity building/technical assistance to these states to further stimulate competitive proposals from these states. Ideally, three years from now, a new COV will not see the need to renew a call for greater geographic diversity that began in 2009.

Distribution of Research across Content Areas

According to Table 9 of the draft Westat portfolio evaluation of projects submitted in response to the DR K-12 solicitations in 2009-2011, 9.5% of proposals were classified as having general or unspecified STEM content, 20.9% as having general or unspecified science content, and 25.0% unspecified mathematics content. We are unsure how to interpret these figures.

If it is really the case all of these proposals do not specify any particular content, then we see that as a concern for proper portfolio balance. Some of these proposals may not state what the content is; if so, there are concerns related to funding proposals without any indication of what the content is. Such proposals make it more difficult to evaluate whether the PIs are likely to be working with accurate science

or mathematics content. Other proposals may be treating the target knowledge as generic scientific or mathematical knowledge (e.g., learning scientific reasoning in general). In this case, there may be concerns regarding the adequacy of the underlying theory of learning and instruction. There is a growing body of research that supports the contention that learning to reason must be done in the context of specific content. It would be appropriate to use multiple content contexts rather than a single context to encourage more generalized knowledge, but not generic contexts.

However, the data in the Westat evaluation may possibly refer to content that crosses boundaries, such as the topic of energy which is addressed in units on earth sciences, chemistry, physics, and biology. If this is the case, the COV recommends that the portfolio evaluation differentiate between cross-disciplinary topics and generic or unspecific topics.

Among those projects with specified content, the COV judged the balance between mathematics and science topics to be within an appropriate range. However, with the new emphasis in standards on engineering, it appears to be desirable to increase the proportion of projects addressing engineering content from the 6.8% reported in the Westat evaluation.

OTHER TOPICS

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

There is a general agreement among Program Officers, reviewers, and proposers that teachers' content knowledge matters. And yet, the COV's informal analysis of proposals, including funded proposals indicates that proposals tend to provide inadequate information regarding the content-based education that pre-service or practicing teachers will receive as part of a funded project. Moreover, when the amount of professional development teachers will receive is quantified, it often seems inadequate to result in necessary gains in content knowledge to achieve the goals of the research project.

Thus, the COV sees a need for the DR K-12 Program to ensure quality and adequacy of professional development opportunities, for projects to use measures of teacher knowledge (such as the NSF-funded Knowledge of Mathematics for Teaching assessments) that permit comparison of gains in teacher knowledge across grants, and for research projects that help the field understand the amount and quality of professional development required to make significant improvements in teacher knowledge.

- There is a need for more mathematics teacher educators and mathematicians to serve as Program Officers.
- There is a need to research/understand how PI meetings and other potential program activities help to build a community of practice.
- The COV noted that proposals do not always address underlying educational issues that impact the effectiveness of a project.
- The COV acknowledges the efforts of NSF to encourage proposals which address the link between teacher professional development and student outcomes and encourages NSF to prioritize funding based on student learning rather than student outcomes.

Moving towards a Cumulative Science

The COV would like to see a purposeful effort towards moving STEM education research towards a more cumulative science which builds on prior work rather than reinventing wheels. A plan to nudge this process forward could include:

- *More synthesis grants,* to pull together what has been accomplished to date and identify remaining gaps and important questions
- *Purposefully foster the development of a community of practice,* informed by the research on how communities of practice form and evolve. Possible mechanisms include: more workshop grants, more attention to community-building at the PI meetings, and more attention to community-building at panel meetings.
- *Sharing of common instruments, and perhaps a data repository for data from such instruments.* Such instruments must be of demonstrably high quality with respect to validity and reliability. Such a data repository must be structured with careful attention to human subjects protections.
- *Longer grants.* Short grants encourage superficial scholarship, as PI's struggle to complete their project before its sunset date. Five year grants for large projects would allow more time for scholarly attention to data analysis, and for carefully situating project results into the existing body of scholarship.

Dealing with the Increasing Proposal Pressure

Over the three years considered by the COV, the number of DR K-12 proposals has increased enormously. Although the COV finds that the DR K-12 review process to date has been robust, we foresee that if the number of proposals continues to increase, the quality of the review process is in danger of deteriorating as the workload increases on program staff and panels. There are no good or easy solutions to this problem. Yet we feel that it is essential for NSF to consider steps to forestall this outcome. Among the steps that could be considered are:

- Require pre-proposals and only encourage full submissions from strong pre-proposals.
- Use panel summary and PO feedback to discourage resubmission of proposals that are unlikely to become competitive for funding.
- Limit the number of resubmissions. NIH, for example, allows only two submissions of the same idea.
- Increase the percentage of low-scored proposals not discussed by panels.
- Cut the number of reviews per proposal to 4 from 5+, thus potentially allowing more proposals per panel. This action is currently under consideration by DR K-12. The COV is not enthusiastic about this option as it degrades the overall quality of review process without greatly increasing the number of proposals that can be processed.

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.

DR K-12 should support efforts to investigate and develop new research methodologies that are appropriate for addressing the more complex research questions arising from the educational community. Specifically, methods that provide an understanding of contexts and lead to causal inferences which help to understand how contextual factors impact outcomes of the research should be encouraged.

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

The COV feels that the heavy workload for POs and other NSF staff along with limited funding/resources can impact a program's ability to meet its performance goals.

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

The COV encourages NSF to remain independent from other federal agencies to ensure their unique perspective on STEM related education.

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

The COV listed the following items for future COV reviews:

- Provide more disaggregated data about reviewers.
- Provide more information about the review process related to proposals. How are decisions made to pursue certain types of projects over others, etc?
- The COV commends the preparation provided by the PO and their staff for our work. We held a webinar early enough to help us understand the process, and we allocated jackets for review well in advance of our meeting, thus enabling us to accomplish our tasks in the meeting. The documents loaded on the e-jackets website provided sufficient background for us to prepare our report. We strongly recommend the levels of support that we experienced for all COV meetings.
- The COV appreciated receiving the email about our focus. Receiving the email earlier would have helped with the process.
- The COV expressed the necessity of having a technical writer present during the COV meetings. We specifically appreciated having a technical writer to assist us in keeping track of our ideas during free flowing conversations, to compile the sections for the report from the working teams, to help facilitate the COV in staying on track with deadlines, and to serve as the overall editor of the drafts of the final report.
- Any cross-cutting questions or key questions of importance should be provided to the COV explicitly at the beginning of the report.
- The COV felt two sections of the COV Report Template did not provide explicit directions or enough guidance: Section III - Management, Question 2 and the over-arching prompt in Section IV.

SIGNATURE BLOCK:

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For the Discovery of Research K-12 (DR K-12) COV

Dr. Ron Marx, DR K-12 COV co-Chair

Dr. Willie Pearson, DRL/HRD Bundled COV Chair