CORE QUESTIONS and REPORT TEMPLATE
For
FY 2002 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to the COV: The COV report should provide a balanced assessment of NSF's performance in two primary areas: (A) the integrity and efficiency of the ***processes*** which involve proposal review; and (B) the quality of the ***results*** of NSF's investments in the form of outputs and outcomes which appear over time. The COV also explores the relationships between award decisions and program/NSF-wide goals in order to determine the likelihood that the portfolio will lead to the desired results in the future. 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.* Discussions leading to answers for Part B of the Core Questions will involve study of non-confidential material such as results of NSF-funded projects. It is important to recognize that the reports generated by COVs are used in assessing agency progress in meeting government required reporting of performance, and are made available to the public.

Clear justifications for goal ratings are critical – ratings without justifications are not useful for agency reporting purposes. Specific examples of NSF supported results illustrating goal achievement or significant impact in an area should be cited in the COV report, with a brief explanation of the broader significance for each. Areas of program weakness should be identified. *COV members are encouraged to provide feedback to NSF on how to improve in all areas, as well as the COV process, format, and questions.*

FY 2002 REPORT TEMPLATE FOR
NSF COMMITTEES OF VISITORS (COVs)

Date of COV: May 9-10, 2002
Program/Cluster: NSF Graduate Teaching Fellows in K-12 Education
Division: Graduate
Directorate: Education and Human Resources
Number of actions reviewed by COV:

PART A. 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. Please do not take time to answer questions if they do not apply to the program.

A.1 Questions about the quality and effectiveness of the program's use of merit review procedures. Provide comments in the space below the question**.** Discuss areas of concern in the space below the table. **Section 3 Overview**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	YES, NO, or DATA NOT AVAILABLE
Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: Review of appropriate documents including overview instructions to the panelists indicates that the review mechanism is appropriate.	**Yes**
Is the review process efficient and effective? Comments: Review of appropriate documents including approvals as well as declinations indicates that the review process is both efficient and effective.	**Yes**
Is the time to decision appropriate? Yes. Review of appropriate documents including program folders and statistical records indicates that the time to decision is appropriate.	**Yes**
Is the documentation for recommendations complete? Comments: Review of the appropriate information indicates that the documentation for recommendations is complete.	**Yes**
Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines? Comments: Review of the merit review procedures alongside program solicitations, announcements, and guidelines indicates that reviews are consistent with priorities and criteria stated in those documents.	**Yes**

Discuss issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures:

COV found overall quality and effectiveness of the program's use of merit review procedures to be adequate.

A. 2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers. Provide comments in the space below the question. Discuss issues or concerns in the space below the table. (Provide fraction of total reviews for each question)

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	% REVIEWS

What percentage of *reviews* analyzed address the intellectual merit criterion? Comments: All of the reviews analyzed addressed some portion of the intellectual merit criterion.	%100
What percentage of *reviews* analyzed address the broader impacts criterion? Comments: All of the Jackets reviewed addressed the broader impacts criterion.	%100
What percentage of *review analyses* (Form 7's) examined by the COV comment on aspects of the intellectual merit criterion? Comments: All of the folders reviewed by the COV commented on at least some aspects of the intellectual merit criterion.	100%
What percentage of *review analyses* (Form 7's) examined by the COV comment on aspects of the broader impacts criterion? Comments: All of the folders reviewed by the COV commented on aspects of the broader impacts criterion.	100%

Discuss any concerns the COV has identified with respect to NSF's merit review system.

The COV suggests that Program Directors within the Directorate supplement the language in the NSF proposal review process to appropriately address the expanded meaning of intellectual merit in the GK-12 Program.

The COV believes that because this is not a traditional research program, it would be useful to provide some examples that illustrate the ways in which the intellectual merit of the proposed activity might be demonstrated, specifically the ways in which the proposed activity "advances knowledge and understanding within its own field or across different fields," and "explores creative and original concepts." Although the metrics by which these substantive and original contributions might be measured may differ from typical research programs, i.e., they may be more likely to emphasize measurable differences in student learning outcomes as a result of different pedagogical approaches, it is important that proposals demonstrate the lasting changes/improvements in the STEM field – the intellectual merit - that can be expected as a result of the project.

A.3 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space below the table.

SELECTION OF REVIEWERS	**YES, NO Or DATA NOT AVAILABLE**
Did the program make use of an adequate number of reviewers for a balanced review? Comments: Based on the review of appropriate documents, such as a three-year summary of data on the program, it appears that the program made use of an adequate number of reviewers for a balanced review.	**Yes**

Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Review of three years worth of data shows that the program made use of reviewers with the appropriate expertise and qualifications.	**Yes**
Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments: Review of three years worth of data shows that although there are a small group of minorities initially, each year the numbers have improved	**Yes**
Did the program recognize and resolve conflicts of interest when appropriate? Comments: Evidence from files showed that any conflict of interest had been dealt with adequately.	**Yes**
Relative to conflict of interest situations, did the program provide adequate documentation to justify actions taken? (words in italics added by program to clarify issues) Comments: The COV found in reviewing files that procedures for dealing with conflict of interest were adequate.	**Yes**

Discuss any concerns identified that are relevant to selection of reviewers in the space below.

Some members of the COV noted that there were few social scientists on the panels, and it was not clear whether participants who had disabilities were being put on the panels. The COV feels that those kinds of distinctions should be made more clearly in the future.

A.4 Questions concerning the resulting portfolio of awards under review.

Provide comments in the space below the question. Discuss areas of concern in the space below the table.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE

Overall quality of the research and/or education projects supported by the program. Comments: Overall the COV finds the portfolio of awards under review to be of high quality. The following are examples of these findings: CONCERNING FELLOWS Graduate Fellows served as instructors and facilitators in one of four multi-week summer professional development programs, sponsored through the participating universities. Fellows greatly improved teaching abilities, gained an appreciation of the challenges and constraints faced by classroom teachers, and learned new science content through teaching and through learning from other Fellows in their area of expertise. Fellows participated in summer training workshops to familiarize themselves with inquiry-based learning pedagogy, classroom management and effective teaching skills, and appropriate uses of educational technologies. Fellows are trained in teaching and communication skills to better serve as conduits of knowledge transfer. By developing and delivering technical content in k-12 classrooms, Fellows also hone their own skills and self-confidence while serving as role models to encourage young students to consider careers in engineering and technology. At the end of the academic year, most GK-12 Fellows indicate that they have greater confidence in their ability to effectively communicate what they know to both k-12 students and to the science community as a result of being in the program. CONCERNING K12 STUDENTS Enhanced learning experiences for middle school students were a tangible outcome. Feedback from teacher and middle school student participants indicated that the Fellows brought content area expertise, awareness of career and educational opportunities, increased levels of hands-on instruction and provided individual attention in the classroom. In the first year, 200 middle school students visited a university for the first time and benefited from an “insiders tour” led by the GK-12 Fellows. In addition to their direct contact with students, products such as web sites, Power Point presentations, and other instructional materials were developed and are now a permanent part of the teacher’s resources. Response to a short questionnaire completed by middle school students in participating classrooms suggests that these students experienced an enhanced learning environment, deeper learning of content and new curriculum that was “hands-on.” The students also commented that they enjoyed having opportunities to develop relationships with scientists and mathematicians. In summary, we consider the most important accomplishment to be the scientific knowledge transmitted to k-12 students and their teachers by Fellows and Fellows modeling what a scientist is for those students. Fellows enrich content knowledge of the students who experience how science and math studies translate into useful applications to address	**Nuggets Summation of Awards**

Are awards appropriate in size and duration for the scope of the projects? Comments: Yes, but the P.I.'s did not report on the sustainability of their projects. The projects were three years in duration. It was not clear what the proposal for sustainability would be. Reviewers did not comment on it.	**Yes**
Does the program portfolio have an appropriate balance of • High Risk Proposals Comments: Yes. One example is Georgia State University (0086392) Barbara Baumstark. Georgia State University instituted a bio-bus program with the help of faculty, students and staff. The project utilizes a 30-foot mobile instructional laboratory to produce hands-on science activities. Since 1999 bus & staff have visited nearly 150 metropolitan area schools. The grant gave the program the ability to expand, including using graduate students to help with new programs in physical sciences, earth sciences and environmental sciences. In addition, they have expanded their geographical boundaries to include seven rural Georgia counties.	**Yes**
• Multidisciplinary Proposals Comments: Yes. An example of a multidisciplinary proposal is the one at Clemson University (0086426) Luedman. The project works to improve student performance and the teaching of mathematics and science in the middle grades in schools in local school districts through the use inquiry-based learning exemplifying a standards-based approach. Although most projects appear to include a variety of STEM fields, it is important to note that we found few (or no) examples of projects that we would consider interdisciplinary.	**Yes**
• Innovative Proposals Comments: An example of an innovative program is San Diego State University (9979741) Oechel. The Pisces project partnered with numerous school districts to facilitate the use of a hands-on standards-based elementary science curriculum in San Diego area elementary schools. The project has grown from 24 teachers representing 7 school districts and 10 Science Corps Fellows to over 100 teachers from 14 districts and 22 Fellows.	Yes

Of those awards reviewed by the committee, what percentage of projects addresses the integration of research and education? Comments: Of the projects reviewed by the COV (10 out of 13) had addressed the integration of research and education. In particular, Cornell University (9979516) Krasny does this. In this project, Fellows have developed and implemented curricula designed to engage high school and middle school youth and teachers in environmental sciences research and inquiry. Another example is Rutgers University, New Brunswick (9979491) Scott. This GK12 program enhances middle school science and mathematics education by creating dynamic learning environments partnering Rutgers graduate and advanced undergraduate students in science, mathematics, engineering, or technology (SMET) with teachers, administrators, and students in New Jersey school districts. Finally, there is the University of Washington (0086280) Adams. This two-part project first focuses on placing six GK-12 Fellows in a K-5 minority school with a Fellow assigned to every mathematics classroom where they partner with teachers to implement an exemplary mathematics curriculum. The second part of the project places six Fellows to tag-team teach in a learning cluster (a junior high school and its feeder elementary school).	Percentage **85%**

Discuss any concerns identified that are relevant to the quality of the projects or the balance of the portfolio in the space below.

The COV raised a concern about the fact that the reviewers did not comment on the issue of sustainability of the projects after the three-year funding cycle. It appears that the projects should be of longer duration. Three years does not seem long enough to stabilize the new partnerships, or to evaluate the impact of the projects as measured by K-12 and graduate student learning outcomes. We propose a longer grant period (5 years) accompanied by a mid-course evaluation.

The COV finds that the entire GK-12 program is high risk in the sense that it is so new and so innovative. There should be ample time provided for the traditions of these programs to take hold.

It was not clear from the review of the projects that the issues and concerns of graduate students were documented in any consistent way. In fact, for several programs the goals listed included items for teachers and K-12 students but omitted goals for the graduate students. This is an issue that P.I.'s need to address.

PART B. RESULTS: OUTPUTS AND OUTCOMES OF NSF INVESTMENTS

NSF investments produce results that appear over time. The answers to questions for this section are to be based on the COV's study of award results, which are direct and indirect accomplishments of projects supported by the program. These projects may be currently

active or closed out during the previous three fiscal years. The COV review may also include consideration of significant impacts and advances that have developed since the previous COV review and are demonstrably linked to NSF investments, regardless of when the investments were made. Incremental progress made on results reported in prior fiscal years may also be considered.

The attached questions are developed using the NSF outcome goals in the 2002 Performance Plan. The COV should look carefully at and comment on (1) noteworthy achievements of the year based on NSF awards; (2) the ways in which funded projects have collectively affected progress toward strategic outcomes; and (3) expectations for future performance based on the current set of awards. NSF asks the COV to reach a consensus regarding the degree to which past investments in research and education have measured up to the annual strategic outcome goals.

The COV's should address each *relevan*t question. Questions may not apply equally to all programs. COVs may conclude that the program under review appropriately has little or no effect on progress toward a strategic outcome, and should note that conclusion in the COV's report.

The following report template provides the broad FY 2002 Strategic Outcomes for People, Ideas and Tools, the FY 2002 performance goals for each outcome, and the specific indicators used to measure performance in meeting the annual performance goal. If the COV members are not sure how to interpret the goal or indicators for the particular program, they should request clarification from the NSF program staff.

To justify significant achievement of the outcome goals and indicators, COV reports should provide brief narratives, which cite NSF-supported examples of results. For each NSF example cited, the following information should be provided in the report:

NSF Award Number
PI Names
PI Institutions
Relevant Performance Goal/Indicator
Relevant Area of Emphasis
Source for Report

B.1.a COV Questions for PEOPLE Goal

NSF OUTCOME GOAL for PEOPLE: Developing "a diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens."

Consider each of the seven indicators for the PEOPLE goal. Has the activity supported projects that demonstrate significant achievement for the PEOPLE outcome goal indicators? To justify your answer, provide NSF-supported examples for each of the relevant indicators that apply to the activity and explain why they are relevant or important for this outcome in the space following the table. If projects do not demonstrate significant achievement, comment on steps that the program should take to improve. Please do not discuss if the indicator is not relevant to the activity.

PEOPLE GOAL INDICATORS	PROGRAM ACHIEVEMENT SIGNIFICANT, OR NOT SIGNIFICANT, OR DOES NOT APPLY, OR DATA NOT AVAILABLE (select one)

Development of well-prepared scientists, engineers or educators whose participation in NSF activities provides them with the capability to explore frontiers and challenges of the future; Comments: The COV agrees that while the program is only in its third year, it appears to be significant. The purpose of this project is to have GK-12 Fellows contribute toward the improvement of the Nation's educational enterprise, and to enhance both the appreciation and capability of graduate students for high quality science, mathematics, engineering and technology teaching. It will enhance GK-12 teachers' content knowledge and understanding of principles of science and mathematics, and it will offer enriched learning by K-12 students. For example, (0086465), Arizona State University, BL Ramakrishna source of report: 01-02 annual report. There is preliminary data suggesting that this will occur. In interviews with both Fellows and teachers, teachers felt that Fellows had a greater understanding of the skills needed for teaching science and technology through inquiry and that Fellows felt more comfortable interacting with students. Teachers themselves reported feeling more comfortable teaching new science/technology concepts after working with an ASU Fellow. The number of K-12 students who would consider science as a career went from 32.5% to 45.2% in one semester of having a Fellow in the class. Another case is 0139171, Harris, "Developing Science Graduate Students into Middle Grade Science Classroom Resources." The primary goal of this project is to improve scientific literacy in middle schools and to excite and stimulate scientific curiosity in middle school students. The goal is accomplished by training a core of science teachers and students and introducing technology and hands-on material into middle schools. Finally, 0086378, University of Akron, Niewiarowski, "Development of Well Prepared Scientists", is a project composed of partners in the Akron School District, Cuyanoga Valley Environmental Centers, and Batin Township Elementary School. In this project, graduate Fellows work toward a master's degree and a certificate in education in the life science disciplines of aquatic life integrative biology (invasive species wetlands).	**significant**

Improved science and mathematics performance for U.S. K-12 students involved in NSF activities; Comments: The COV agrees that the project demonstrates significant potential for improving the mathematics and science performance of K-12 students, for example, 9979593, Tufts University, Cyr. "Improved Science and Mathematics Performance for U.S. K-12 Students". The state of Massachusetts is perhaps the first and only state to incorporate engineering and technology into the statewide K-12 learning standards. The College of Engineering, in collaboration with the Department of Engineering at Tufts is working with the Nashoba Regional School District to develop courses and course modules, using engineering and content knowledge necessary to demonstrate mastery of those standards; engineering design projects are also being used to help teach basic physics and mathematics principles. In one example of such an engineering design project, a Tufts G K-12 Fellow works in a 5th grade-engineering lab, co-sponsored by Intel and Logo. Another project developed a 9th grade engineering AP course that was highly regarded by students in the course.	**significant**
Professional development of the STEM instructional workforce involved in NSF activities; Comments: The COV considers the GK-12 program successful in demonstrating professional development of the STEM instructional workforce involved in NSF activities, for example, 9979566, Arce, University of Puerto Rico, proposal and award Jacket, site visit report. In this project GK-12 teachers reported improved understanding of science and mathematics principles. The Fellows report improved communications skills in explaining concepts to educated laypersons, in fostering their own understanding of fundamental concepts, and in enhancing their knowledge of how students learn.	**significant**

Contributions to development of a diverse workforce through participation of underrepresented groups and *service to such groups* (women, underrepresented minorities, persons with disabilities) in NSF activities –Including significant numbers of underrepresented students within the Fellowship cohorts Comments: The COV agrees that this is a significant indicator of success of the project. For example, 9979496, University of Washington, Denton, the G K-12 Program is partnering with the University's Disabilities, Opportunities, Internet Working and Technology (DO-IT) program to provide GK-12 Fellows with disabilities as role models in on-going NSF, U.S. Department of Education and State of Washington supported projects. These projects are designed to encourage K-12 students with disabilities to pursue careers in STEM fields and help them develop the skills to do so. The GK-12 program also works collaboratively with the UW Center for Women in Science and Engineering Program to recruit Fellows from underrepresented groups. In another example, 9979553, University of Kansas, Robinson (Proposal and award Jacket, site visit), the site visit report indicates that 34% of the Fellows are from underrepresented groups and that they work with the teachers in schools heavily populated by students from minority groups. Both the Fellows and the K-12 teachers report enthusiasm with the program (anecdotal evidence). A principal at one of the participating high schools reports a reduced number of absences, fewer discipline problems and increased graduation rates. In another example, 9979504, Texas A&M University, Corpus Christi, Marinez, (Rural Systemic Initiative – Proposal – Jacket), Texas A&M University, Corpus Christi, and West Texas University, Canyon partnered to work in two different school districts, Hereford and Beeville, which are 600 miles apart. The project supports 9-12 grade teachers in rural schools with large Hispanic populations. This network of Universities provides state curriculum standards, guidance, and professional development for teachers. The program provides increased communication skills for Fellows, improved and innovative curriculum standards for teachers, introduction of new technologies and equipment, increased connection between the University and the K-12 sector, and professional development for teachers. Finally, there is 9979750, University of Alabama, Krannich. (Jacket), The University of Alabama has alliances with a dozen historically black colleges and universities in and around Alabama. In conjunction with their AMP Program, they actively recruit graduate students into STEM.	**significant**

Participation of NSF scientists and engineers in international studies, collaborations, or partnerships. Comments: The COV found that it was appropriate to use this indicator of success to assess the success of the GK-12 program. . For example, 9979496, University of Washington Denton (proposal and award Jacket, site visit report), this project was awarded a supplement to the grant in May 2000, to send Fellow/teacher pairs to Japan and China to develop K-12 partnerships. Goals included sharing of ideas and best practices for introducing inquiry-based learning in K-12 SMET curricula and fostering creativity in K-12 settings. Visits to China and Japan took place in the summer of 2001. The COV did not find any evaluation information about this international component of the PRIME project. Another example of a GK-12 project that focused on international science was 9979656, University of Hawaii, Kanishiro, The University of Hawaii provides students an opportunity to work in Ryukyu Islands, Japan in the areas of evolutionary biology and conservation biology. The project is using web-based communications as well as some actual site visits to enhance science preparation in several K-12 schools in Okinawa. .	**Significant,**

Awardee communication with the public in order to provide information about the process and benefits of NSF supported science and engineering activities. Comments : The COV considers the GK-12 successful in demonstrating awardee communication with the public in order to provide informaiton about the process and benefits of NSF supported science and engineers. For example, 9979547, Northeastern University, Blackman (Proposal Jacket), the program partners with the Hewlett Packard Foundation, Boston Museum of Science, The Philanthropic Initiative Foundation, The New England Aquarium and the Boston Public Schools to cross-fertilize the experience of Fellows to the urban educational environment. K-12 students and teacher are enhanced in the areas of technology and science. Both the Muséum and Aquarium provide professional development activities for Fellows and teachers, sometimes pairing amateur or professional scientists with teachers. Retired scientists and engineers (RESEED) volunteers also serve as resources to Fellows. Another example is 0086358, University of Nebraska, Pelecky (Proposal Jacket) where University of Nebraska GK-12 Fellows each develop a web page with science facts, tips and projects that are available to students, parents and educators throughout the community and nation. Fellows conduct a series of family science nights in conjunction**** with the Lincoln Children's Museum and serve as resources in social studies classes, when physical science topics, e.g., low level radioactive dumping, are part of a current event assignment. Finally, in 9979656, University of Hawai, Kaneshiro (Proposal Jacket), data from a Fellow-led research project assessing the distribution of an invasive ant species provided information used by the Hawaii State Agricultural Department. Environmental Agencies for the state and for the Honolulu County and City have expressed an interest in using data collected through the 7th grade watershed study.	**significant**

Word in italics represent a modification made to the general template to accommodate program specific elements.

Provide one or more examples of NSF supported results with award numbers to justify each selection above. For each example, provide a brief narrative, to explain the importance of the result in non-technical terms. For each NSF example cited, include the following information:

NSF Award Number
PI Names
PI Institutions
Relevant Performance Goal/Indicator
Relevant Area of Emphasis
Source for Report

B.1.b COV Questions related to PEOPLE Areas of Emphasis

For each relevant area shown below, determine whether the program's investments and available results demonstrate the likelihood of strong performance in the future? Justify your argument by providing NSF-supported examples of investment results (with grant numbers) that relate to or demonstrate outcomes for the PEOPLE goal and relevant indicators. If the area of emphasis is not relevant to the activity, do not discuss.

PEOPLE AREAS OF EMPHASIS	Demonstrates likelihood of strong performance in future? (Yes, No, Does Not Apply or Data Not Available)
K-12 Education President's Math and Science Partnership Initiative *Potential for interaction with the President's Math and Science Partnerships* Comments: The COV agrees that this GK-12 program demonstrates the likelihood for strong interaction with the President's Math and Science Partnership Initiative.	**If Yes, provide award #s**
Learning for the 21st Century: • NSF Graduate Teaching Fellows in K-12 Education (GK-12) *Potential for interaction with the Centers for Learning and Teaching* Comments: The COV agrees that the GK-12 program strongly demonstrates the potential for interaction with the Centers for Learning and Teaching. The following universities: (0086397) Texas A&M, Corpus Christi, (0086396)University of Maryland College Park, and (9979628) University of Wisconsin, Madison all have both Teaching and Learning Centers and GK-12 programs on their campuses. It should be quite easy for these two programs to collaborate at these campuses. These two programs working together could become a national pilot program.	**If Yes, provide award #s**

Broadening Participation --Minority-Serving Institution (MSI) programs Comments: The COV strongly agrees that the GK-12 program demonstrates the likelihood of strong performance in the future to partner with MSI's (Minority Serving Institution Programs). GK-12 programs that would make strong candidates include, 0139108, Krannich, University of Alabama, 0086448, Rutgers University, Newark, Kidden, and 9979504, Texas A&M, Corpus Christi, Marinez. **Graduate Student Stipends** **-Increasing stipends for GK-12** Comments: The COV agreed that the increase in stipends for Fellows would be a very positive outcome. There was a concern that NSF should be aware that this increase in the amount of the stipend could create tension on some campuses to push them to also raise their own graduate students' salaries at a time when the economy is in a downward swing. This potential hardship on campuses could also be a detrimental factor in sustaining GK-12 programs beyond NSF funding.	**If Yes, provide award #s**

Word in italics represent a modification made to the general template to accommodate program specific elements.

Provide one or more examples of NSF supported results with grant numbers to justify each selection above. For each example, provide a brief narrative to explain the importance of the result in non-technical terms. For each NSF example cited, include the following information:

NSF Award Number
PI Names
PI Institutions
Relevant Performance Goal/Indicator
Relevant Area of Emphasis
Source for Report

Comment on steps that the program should take to improve performance in areas of the PEOPLE goal.

IDEAS INDICATORS	PROGRAM ACHIEVEMENT
Partnerships that enable the flow of ideas among the academic, public or private sectors. Comment:	**significant**

The COV agrees that the following examples show that the programs in the GK-12 initiative provided partnerships that enable the flow of ideas among the academic, public or private sectors. For example, 0056358 University of Nebraska, Leslie – Pelecky, (Project Jacket), in which the GK-12 Fellows each develop a web page with science facts, tips and projects that are available to students, parents, and educators throughout the community and nation. Fellows conduct a series of family science nights in conjunction with Lincoln Children's Museum and serve as resources in social studies classes, when physical science topics, e.g., low-level radioactive dumping, are part of a current events assignment. In another example, 9979566, University of Rhode Island, Merril,, one of the successful aspects of the program has been the three-week summer teacher institute where the Fellows and their teacher partners engage in marine and environmental science, content instruction, field exercises, and technology instruction. The teachers have expressed a great deal of satisfaction and enthusiasm for the field exercises (10 trips during each institute). Not only are the exercises instructive and enjoyable, they give the teachers new tools for leading similar exercises for their students in the same locations. Because of their GK-12 experience, Fellows reported feeling more comfortable discussing their own research with nonscientific audiences.	

Provide one or more examples of NSF supported results with grant numbers to justify each selection above. For each example, provide a brief narrative to explain the importance of the result in non-technical terms. For each NSF example cited, include the following information:

NSF Award Number
PI Names
PI Institutions
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Relevant Area of Emphasis
Source for Report

B.4 Please comment on any program areas in need of improvement.

The COV recommends that in future programs more attention be given to the way in which the GK-12 Fellowship contributes to the overall career preparation of fellows, to issues related to the timing of the GK-12 Fellowship experience in a graduate career so that optimal benefit can be realized, and to

engage/more effectively communicating with fellows' thesis and dissertation advisors.

B.5 Provide comments as appropriate on the program's performance in meeting program-specific goals and objectives, which are not covered by the above questions.

The COV found that the program-specific goals and objectives are covered by the questions asked above.

B.6 NSF would appreciate your comments for improvement of the COV review process, format and report template.

The GK-12 proposal management system is very positive, and the attention to documentation and conflict of interest procedures are models for the field. GK-12 program staff are doing a very impressive job maximizing the outcome and outputs of the review and grant process. This new template is helpful because we see both the GPRA template compared alongside the GK-12 template. The GPRA measure focuses on ultimate outcomes - people, ideas, and tools, whereas for the purposes of this project, the review focused only on people and ideas.

There were enough tags on the Jackets, the Jackets were laid out in the review room, and they were appropriately marked for our use. The staff put together notebooks that contained valuable information for our use. The site visit reports also provided additional insight and formative evaluative information.

To improve the process to make it even better, we recommend that

- All of the Jackets are located in one place. There were a few proposal Jackets that were not in the files and we had to have the staff go to find them.

Program Specific Questions:

1. Do current strategies and practices enable the GK-12 program to effectively serve the needs of Graduate and Undergraduate Fellows, have an impact on the university, and increase collaboration between the university and K-12 schools? Please suggest any improvements to pursue.

The COV notes from all of the available material that the current practices and strategies appear to enable the GK-12 program to effectively serve the needs of undergraduate and graduate Fellows. The program is only three years old but from all indication it has the preliminary evidence to show that the Fellows, for the most part, are benefiting from the experience. Summaries from the nuggets gleaned from site visits show that Fellows develop a greater appreciation for the teaching and learning process, inquiry-based learning pedagogues, and new media instructional technologies. At the end of the academic year, most Fellows indicate that they have greater confidence in their ability to effectively

communicate what they know to both K-12 students and to the science community as a result of the program.

Impact on University – The COV found indications from the Jackets, site visit reports, and reports from Fellows, teacher mentors and university professors and project nuggets that there is positive impact on Universities. Examples of this include strengthened ties with K-12 districts, closer interaction between schools of education and university science programs, and strengthened ties between universities and other educational and research sites in the various communities (museums and research labs).

Collaboration Between University and K-12 Schools – All indications from information gleaned from program nuggets, site visits, and external evaluations show that one of the major positive results of the project are the positive partnerships that are formed between universities and K-12 programs. One question the COV notes is what will happen to sustain the partnerships after the three-year project has ended. This project is unique in that it is a win-win proposition for both the universities and the K-12 school districts.

The following are additional recommendations for ways to improve current strategies to serve

graduate students – The COV encourages the NSF GK-12 program to be more deliberate in distinguishing between the benefits of the program for graduate and undergraduate students. It was felt that a number of the programs we reviewed did not clearly emphasize the needs of the graduate students. This issue of the likely impact on the professional/career development of graduate students was not evident in the stated goals of a number of the funded programs, which listed goals for K-12 students and teachers, but neglected to mention graduate student desired outcomes. While the COV feels that graduate student Fellows participating in these programs will derive benefits, their specific goals and objectives should not be omitted from the goals of the overall program. Specifically, we think it is important that more attention be given to the way in which the GK-12 fellowship contributes to the overall career preparation of fellows, to issues related to the timing of the GK-12 fellow experience in a graduate career so that optimal benefit can be realized, and to engaging/more effectively communicating with fellows' thesis and dissertation advisers. While we appreciate the benefit of the K-12 educational experience, it is not clear that the Fellows will benefit from the second year fellowship that a number of projects are proposing. In fact, the reasons given for the benefit to K-12 education are that the Fellows are better able to communicate, teach, etc., thereby showing the Fellows outcomes were achieved in the first year. More study should be undertaken to address this issue.

Finally, with respect to graduate and undergraduate student needs, there was little evidence of any distinction being drawn between the different (if they exist) goals/outcomes desired for the undergraduate and graduate students. For example, for graduate students a common goal is for students to be able to better communicate their research to those not acquainted with the field. It is not expected that this will be a goal for undergraduates. On the other hand, a possible outcome for undergraduates is their entering the teaching profession.

2. Does the GK-12 program appear to effectively serve the needs of K-12 districts, schools, teachers and students? Please suggest any improvements to pursue including reaching out to K-12 schools with high minority or low-income populations.

The COV finds based on all of the data reviewed that the GK-12 program serves the needs of the K-12 students in very positive ways. Nuggets from the program show that students benefit in the following ways: an enhanced learning environment, a deeper learning of content and new curriculum that is "hands-on", all leading to an increased enthusiasm for science. In addition, Fellows transmit scientific knowledge to K-12 students and their teachers, resulting in, students who are better informed to make choices about their own future math and science options.

The following are concerns and recommendations to pursue including outreach to K-12 schools with high minority or low-income populations:

- There is a concern whether the program is an additional burden on K-12 classroom teachers. While teachers appear to get professional benefit from the program, based on all of the data we reviewed, we need to know how much more of their time participating in the program is taking.
- To reach out to K-12 schools with high minority or low income populations, the COV suggests that the GK-12 program be linked with other NSF programs such as AMP, AGEP, and other grants to partner with local programs to help leverage what is already working and encourage collaboration among majority-serving and minority-serving K-12 districts.

3. Do the strategies and practices of GK-12 supported projects appear to be sustainable beyond the term of NSF support? Please suggest strategies for the program and projects to promote institutionalization of efforts, such as of the incorporation of GK-12 like activities as a means of broadening the university's approach to graduate education.

The COV believes that there is a better chance for sustainability of the GK-12 supported projects beyond the terms of NSF support if the win-win partnership benefits can be sustained between the K-12 school, the students and teachers and the graduate students and the university. Another strategy would be to tie the GK-12 program to other existing local or national programs with similar goals. For example,

- Integrate the GK-12 program with the National Preparing Future Faculty (PFF) Program in which graduate and doctoral students are encouraged to teach in universities and colleges as a part of their professional preparation to become university and college faculty; thus, continuing NSF support for PFF and PFF-like projects is likely to simultaneously enhance GK-12 objectives.

- Integrate service-learning requirements in graduate education programs. Students could do their service learning work around teaching STEM subjects in K-12 schools.
- Senior researchers can be persuaded to include broader definitions of scholarship in their work, and to include the work of the scholarship of teaching in the GK-12 program.

4. Do GK-12 projects offer enhancement of STEM curricular, laboratory, or instructional materials at a variety of educational levels through production of quality locally based materials that reflect global STEM concerns?

The COV finds that there is strong positive evidence to show that the production of quality materials is one of the most positive outcomes of the GK-12 program. For example, materials that have been developed as part of the program are being used in science instruction by the participating teachers and GK-12 Fellows. Feedback from the students, teachers, and Fellows has been extremely positive.

Two specific examples are the University of Arizona (9979516 Hall-Wallace), and Cornell University, (9979516 Krasney) where graduate and undergraduate students have developed and implemented curricula designed to engage high school and middle school, youth and teachers in STEM, environmental sciences research and inquiry.

In summary, graduate Fellows from science, mathematics, engineering and technology departments spent their time inside elementary, middle and high school classrooms, working side by side with classroom teachers. Fellows used state of the art curriculum modules, which were tested and utilized in classrooms.

5. Overall do GK-12 projects increase knowledge and appreciation for STEM and the scientific method by K-12 students and teachers?

The COV finds that there is overwhelming positive evidence that GK-12 projects increase knowledge and appreciation for STEM and the scientific method by K-12 students and teachers. Review of proposal Jackets, site visits and interviews with students and teachers all reaffirm this fact.

6. Do GK-12 projects increase opportunities for K-12 students to do real science?

The COV found through extensive review of materials that K-12 students had the opportunity to engage in real science projects. For example, the University of Pennsylvania (9979635 – Deturck) where Access Science activities in West Philadelphia schools include 500 teachers and 10,000 students working through Access Science activities to achieve, among other things, the creation of sustainable, integrated science and mathematics curriculum, as well as robotics-based professional development for teachers and problem-solving (hands on) activities for students at Drew Elementary School. Another example is the University of Hawaii Manoa (9979656-Kanishiro) where the field oriented research of the graduate Fellows involves K-12 students in inquiry-based science by actually doing the science. Students worked in teams on the Fish Diversity Unity, The Behavioral Ecology Unit, or the Watershed Unit and addressed questions ranging from natural selection, systematics and taxonomy, to behavioral ecology and conservation biology.

Advice to the Program

1. How can we more effectively highlight and disseminate secondary outcomes of the GK-12 program such as STEM instructional materials produced through GK-12 program supported efforts?

The COV recommends the following strategies and activities to more effectively highlight and disseminate secondary outcomes.

- Establish or enhance existing websites to link all of the existing projects to each other to share information, establish discussion boards, share research, curricula and pedagogical styles.
- Need to have learning portfolios for all involved teachers, Fellows and students

- Need studies to show how well materials work over time. Share the lessons learned with people in the project as well as with those who may want to start a project on their own.
- Do a better job of publicizing successes "along the way" not just at the end of the project. Hold press conferences and take out ads in local newspapers.
- Work with disciplinary and professional associations to distribute curricula, best practices and materials. Partner with them to provide training for members.

2. What are appropriate and sufficient data to collect from projects that would allow us to assess the extent to which the program as a whole is successfully progressing towards its intended goals and outcomes?

- improved communication and teaching skills for the Fellows;
  - Follow-up after the Fellowships to find out how the Fellows are doing in pursuing their stated goals and to see what impact the program has actually had on the Fellows decisions around science.
  - Administer Pre and post tests of samples of the Fellows work (explaining their research to someone unfamiliar with the subject) before and after the program.
  - Continue summer programs to orient university faculty, Fellows and K-12 teachers to the expectations and structure of the programs.
  - Continue weekly to monthly seminar series for students, teachers and project leaders to review progress and problems.
  - Conduct evaluations to consider the program effects on the Fellows, including their approach to science, their broadened appreciation of the sciences, ability to communicate, increased understanding of basic concepts of outreach possibilities for STEM programs, as well as their effect on K-12 schools and teachers.
- enriched learning for K-12 students;
  - Conduct pre and post tests on math and science competencies
  - Conduct in-depth interviews to have students track their learning at the beginning, during and at the end of the project
  - Track students to see if they take more science electives after the end of the GK-12 program (particularly look at issues of ethnicity, gender and class).
  - Check to see if students' scores improve on standardized tests in the areas of science and math over time
- professional development opportunities for GK-12 teachers;
  - Assess summer institute participation- use recommendations from the institute to strengthen the role of teachers in the next round of GK-12 grants.
  - Check to see if there is an increase over time in the numbers of teachers who want to participate in the program.
  - Look at the number of teachers who continue to take workshops and participate in other professional development activities after the project is finished.
  - Document the extent to which teachers incorporate their new knowledge into their own curricula and pedagogy.
  - Document the extent to which teachers share materials with other colleagues.

Strengthen partnerships between institutions of higher education and local school districts.

- Establish and maintain a working team of personnel from the local school district before, during and after the life of the project.
- Design projects to continue after the life of the project. If projects are designed to solve a regional or local problem, then there will be a longer-term investment in staying together to try to solve it.
- Increase the number of university faculty who visit and teach in K-12 schools and work in partnership with K-12 faculty on common research and teaching issues.
- Increase the involvement of teachers in the activities of the university including taking sabbaticals, doing research, teaching and guest lecturing.
- Develop joint STEM programs together.

3. What information or practices could be developed to better understand, document and disseminate the materials that GK-12 projects are helping produce and refine, many of them locally based?

- Establish an interactive website (see previous)
- Link with other like organizations such as VIGRE and LSC, with specific schools, with individual teachers or with school districts to capitalize on a number of existing resources, including contributions from informal science education organizations (e.g. Project WET or GLOBE) and institutions (such as zoos, museums and science centers).
- Engage with professional and disciplinary associations to have them help with the dissemination of material. They can also help with changing academic culture in graduate education to be more receptive of programs like GK-12 as well.
- Partner with local agencies and stakeholders at the city, district, county and state levels. Work with state educational agencies as well as other educational ngo's (non-government organizations).

4. Do you have additional suggestions for modifications and effective directions for the program?

- The COV would recommend more active solicitation of applicants from the social scientists. Perhaps you can be more deliberate about getting information into the journals and media sources that they use. Continue to involve them on multidisciplinary review teams.
- The NSF GK-12 Program should have a website to post lesson plans, lessons learned from Fellows, teachers, students and university faculty mentors and other materials. There should be long term assessment built into the process to see if it remains effective over time.
- Sustainability- NSF and the GK-12 Program should sustain funded programs from six to ten years. One three-year period is not nearly long enough to track the impact of the program.
- The GK12 Program needs to be more deliberate about assessing the impact of this program on K-12 teachers. Perhaps this kind of data collection could be captured on a

campus with the joint cooperation of the GK12 Program and The Center for Teaching and Learning.

- The GK-12 Program needs to develop a set of compelling outcomes data now! This innovative program is now three years old. It is time to begin to reap the benefits from the tremendous success of this program, and argue for its sustainability at NSF in higher education, K-12 education and society at large. This program is a winner!
- The GK-12 Program needs a more substantive distribution plan to get all of the benefits of the program out to a national audience. The program should seek out partners who already have established regional and national platforms that would be complementary.(AAAS, disciplinary associations, national professional associations, and K-16 organizations. Link with other NSF dissemination projects as well.
- Look for ways to assess the impact of the GK-12 Program on university campuses-impact on Fellows, impact on faculty mentors, graduate curricula, and on the overall graduate culture.
- Look for ways to support interdisciplinary as well as multidisciplinary projects in the future.