Instructional Materials Development (IMD)

Learning Progressions

Instructional Materials for Students

Assessment

Applied Research

Program Solicitation
NSF 05-612
Replaces Document NSF 04-562

National Science Foundation
Directorate for Education and Human Resources
  Division of Elementary, Secondary and Informal Education

Preliminary Proposal Due Date(s) *(required):*

  November 14, 2005

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

  March 13, 2006

REVISIONS AND UPDATES

Changes in this solicitation include: the addition of a component, *Learning Progressions* (a collaborative effort with the Teacher Professional Continuum (TPC) program); the addition of a statement at the beginning of the Program Description describing funding priorities for FY 2006; and the removal of cost sharing requirements.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

  Instructional Materials Development (IMD)

  Learning Progressions

  Instructional Materials for Students

  Assessment

Applied Research

Synopsis of Program:

The Instructional Materials Development (IMD) program includes four components:

- **Learning Progressions** -- supports the creation of instructional frameworks centered on learning progressions in science and technology education and the development of associated teacher resources and models for professional development.
- **Instructional Materials for Students** -- supports the creation and substantial revision of comprehensive curricula and supplemental instructional materials that are research-based; enhance classroom instruction, preK-12; and reflect standards for science, mathematics, and technology education developed by national professional organizations.
- **Assessment** -- supports the creation of tools for assessing student learning that are tied to nationally developed standards and reflect the most current thinking on how students learn mathematics and science. Projects can also focus on developing resources that provide technical assistance to schools and districts in implementing new assessments.
- **Applied Research** -- supports the research for development of the IMD program and projects; provides evidence for the effectiveness of materials and feedback for strengthening the portfolio; and identifies possible new directions in instructional materials and assessment.

Proposals may be submitted for projects in any field of science, technology, engineering, or mathematics (STEM) education typically supported by NSF.

Cognizant Program Officer(s):

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Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.076 --- Education and Human Resources

Eligibility Information

- **Organization Limit:** None Specified.
- **PI Eligibility Limit:** An individual may serve as the Principal Investigator (PI) for no more than one proposal per round of competition; any exceptions must obtain prior approval, in writing, from the IMD Section Head.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 15 to 18
- **Anticipated Funding Amount:** $7,000,000 pending availability of funds

Proposal Preparation and Submission Instructions

This document has been archived.

A. Proposal Preparation Instructions

- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required by NSF.
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Preliminary Proposals** *(required)* **:**
  November 14, 2005
- **Full Proposal Deadline Date(s)** (due by 5 p.m. submitter's local time):
  March 13, 2006

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

A. **THE DIVISION OF ELEMENTARY, SECONDARY, AND INFORMAL EDUCATION**

The comprehensive programming of the Division of Elementary, Secondary, and Informal Education (ESIE) develops research-based models and high-quality, innovative resources designed to strategically impact the learning and teaching of science, technology, engineering, and mathematics (STEM) education, grades preK-12. Instructional materials and student assessments that promote active investigation, together with new models for teacher education, contribute to STEM classroom environments that serve all students well. Moreover, ESIE media, exhibit, and community-based efforts increase scientific and technological literacy and develop life-long skills for learners of all ages. ESIE programs create a solid educational foundation in STEM disciplines for the future research, instructional, and technological workforce, as well as for students pursuing post-secondary education in other disciplines. All ESIE efforts incorporate innovations that promote high standards in content, pedagogy, and assessment; and through collaborations, capitalize on the strengths of formal and informal education, research and practitioner communities, and major stakeholders (e.g., higher education, school districts, state education agencies).

Program Overviews. Programs administered by ESIE in FY 2005 include: **Instructional Materials Development (IMD); Teacher Professional Continuum (TPC); Centers for Learning and Teaching (CLT); Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST); Informal Science Education (ISE); Information Technology Experiences for Students and Teachers (ITEST)**; and **Advanced Technological Education (ATE)**. The TPC and ATE programs are managed jointly with the Division of Undergraduate Education.

B. **INSTRUCTIONAL MATERIALS DEVELOPMENT (IMD)**

The next generation of scientists, engineers, mathematicians and technologists will need knowledge and skills for which today's curriculum only forms a foundation. Discoveries and understandings that are on the forefront of today's research (e.g., biocomplexity, materials sciences) will be essential and fundamental parts of their world, as will research practices that incorporate modern methods and technologies. Anticipating the education needs of future science, technology, engineering, and mathematics (STEM) professionals is further complicated by the need to incorporate what is relevant from classical approaches to the disciplines with modern methods and content. The workforce needs of the nation are also changing rapidly. According to Murnane and Levy (2004) the most critical skills for future workforce participation are expert thinking (identifying and solving new problems) and complex communication (eliciting critical information and conveying a convincing interpretation of it to others). The STEM education that is provided to our nation's youth needs to meet these challenges, as well as convey the excitement and rapid paced advances of scientific research.

The goal of the IMD program is to enhance STEM content knowledge, as well as the thinking skills and problem solving abilities, of all students, pre-Kindergarten through grade 12 (preK-12), regardless of background, ability, or plans for future education. The IMD program encourages learning by all students through promotion of positive dispositions toward science and technology and of themselves as learners. In addition, it seeks to encourage a broader cross section of students to pursue education in scientific and technological disciplines through the use of real-world contexts. These goals are implemented through support of the development, revision, evaluation, and dissemination of materials and assessments that guide instructional decisions and provide information on depth of student learning of concepts and ideas. In pursuing enhanced student learning of STEM content with depth and understanding, IMD recognizes the need to align teacher content knowledge and pedagogical strategies, and assessment with these materials and assessments.

An evaluation of the IMD program is planned and projects funded in response to this program solicitation are expected to cooperate with this program-wide evaluation.

II. PROGRAM DESCRIPTION

The IMD program consists of four components: *Learning Progressions; Instructional Materials for Students; Assessment;* and *Applied Research,* which are described below.

PRIORITIES FOR FY 2006: The new component, *Learning Progressions,* is the highest priority. Within the *Instructional Materials for Students* component, priority will be given to small-scale projects that develop modules that reflect innovative uses of educational technology, new advances in STEM and/or an interdisciplinary focus. Within the *Assessment* component, priority will be given to science assessment issues. Within the *Applied Research* component, priority will be given to studies around the implementation of existing instructional materials.

LEARNING PROGRESSIONS

Background Information

Science and technology education in K-12 schools tends to lack coherence and widely accepted course sequences that allow educators and instructional designers to build on prior knowledge. This contrasts with NSF- funded K-12 mathematics curricula that are tied to cognitive research and learning progressions that develop over years of schooling (e.g., Achieve, 2003; NCTM, 2000). To build the foundation for more coherent curricula in science and technology, a pilot initiative will support the development of learning progressions (Catley, Lehrer, Reiser, 2005) of STEM content and processes that build student understanding over time. These would build models of instruction and demonstrate how instructional materials and professional development would look over multiple grade bands (K-5, 6-8, 9-12) when intended to support students building deep understanding of a key concept over time. This strategy will contribute to students developing the understandings necessary to participate in STEM careers in the 21st Century. For example, what would a student need to learn and be able to do and what would teachers need to know and teach at each grade level so students would develop an understanding of an idea such as plate tectonics or a process such as modeling in high school? How would teachers be prepared to provide instruction for this content? How would student learning and teacher practice be assessed?

Unlike earlier materials development and teacher professional development projects that often targeted specific disciplines and grade bands, these projects will produce designs, sample materials, and field-based research both to inform the development of future instructional materials and to build developers' knowledge about what teachers need to know and be able to do. These projects will develop learning progressions that span grade bands and foster learning of key processes essential to one or more science or technology discipline. The projects must draw upon current research on teaching and learning and produce design and instructional frameworks that guide the development of future instruction (curriculum materials, teacher preparation and ongoing support, assessment, and implementation). The ultimate goal is to significantly enhance student learning through classroom instruction that is driven by learning progressions.

Funded projects will engage teams with demonstrated expertise in materials development, professional development, assessment, classroom practice, and educational research, and include doctoral level professionals with appropriate disciplinary expertise . For this initiative, the learning progressions are limited to three process strands – modeling, engineering design, and inquiry- developed in the context of important content as specified in national standards. (AAAS 1993; NRC 1996, ITEA, 2000) Even though the strands are initially limited to science and technology education, developers may find it useful to integrate appropriate mathematics topics; in this case, it is expected that the mathematics included will reflect the recommendations of the national standards in mathematics (NCTM, 2000). All exemplars developed under this solicitation are expected to provide guidance for future instructional design and professional development. The Instructional Materials Development (IMD) and Teacher Professional Continuum (TPC) programs are jointly funding this initiative and proposals submitted for *Learning Progressions* will be jointly reviewed. Principal Investigators (PI) on successful proposals will be expected to attend the PI meetings for both the IMD and TPC programs.

The development of instructional frameworks centered on learning progressions must be based on the fundamental ideas of STEM and understandings from the cognitive and educational sciences literature. Such exemplars must support learning and constructing knowledge that are consistent with the developmental level of the students, build incrementally over grade bands, and culminate in deep understanding of core ideas. Recent research summaries (e.g., Donovan and Bransford, 2005 and Etkina, Mestre and O'Donnell, 2005) indicate that instruction for students should help facilitate transfer to new situations, thus promoting conceptual understanding. This conceptual understanding depends on a relatively small set of important ideas that form the core from which students benefit greatly in their study of STEM disciplines. For example, the ability to develop models of a variety of phenomena is a fundamental process that greatly assists students in their ability to understand a variety of topics in science and engineering (Lehrer and Schauble, 2003; Hestenes, Wells, and Swackhamer, 1992).

The Atlas of Science Literacy (AAAS, 2001) provides examples of "strands" (learning progressions) for K-12 students to achieve understanding of important science content concepts described in the Benchmarks for Science Literacy (AAAS, 1993), National Science Education Standards (NRC, 1996) and some of the Standards for Technological Literacy (ITEA,

2000). Less is known about how effective instruction can accelerate the pace at which students are capable of moving along the developmental trajectory of learning processes such as argumentation, design, assessing evidence, experimentation, inquiry, interpretation of data and modeling. Although some of these learning processes are used in all disciplines, they need to be taught in the context of individual disciplines since the standards for knowing, modes of reasoning, and what counts as evidence are different in different disciplines. Students experience change in their observational skills, thinking, and understanding when content learning and processes are integrated.

To develop any of these ideas fully requires a rethinking of what teachers at each grade level need to know and be able to do so they can promote learning and build understanding by students as they move through grade bands so that they develop expertise over time (Donavan and Bransford, 2005). Beyond activities and resources for professional development, projects need models of professional development that address critical knowledge and practices needed to implement materials developed from the learning progressions in classrooms. Specifically, a professional development model describes the "key elements that make up any professional development system … the professional development program; the teachers, who are the learners in the system; the facilitator, who guides teachers as they construct new knowledge and practices; and the context in which the professional development occurs" (Borko, 2004). Additionally, various professional development strategies in a professional development program may better address certain knowledge and practice needs of teachers. For example, course-based strategies may facilitate teachers' needs to enhance their own content knowledge, whereas coaching strategies may facilitate teachers' needs to enhance their abilities to implement new instructional strategies or work with new curricular materials.

Proposals will be accepted for projects of maximum duration of 3.5 years and maximum total budget of $3.0M. Although it is anticipated that the acceptable topics will include both processes and content strands in future years, the pilot round is limited to processes that are generic to many disciplines, broadly applicable and grade band appropriate. Proposals for any one of the following process areas will be accepted: a) student use of modeling to represent structures, processes, data and relationships (Lehrer and Schauble, 2003; Hestenes, Wells, and Swackhamer, 1992); b) the use of engineering design as a problem solving strategy (AAAS, 1993; ITEA, 2000); or c) scientific inquiry that builds the requisite skills to do independent investigations (NRC, 2000). Each of these is expected to have instructional implications for grade bands in K-12 and include a progression of learning and activities that result in deep understanding. The processes must be developed in the context of a single discipline over at least two contiguous grade bands. The goal is to map student learning of processes in the context of important content as defined in the national standards. Additionally, in order to implement these ideas in classrooms, projects must develop appropriate models of professional development to support teachers in translating these learning progressions into classroom instruction.

Successful proposals are expected to provide a conceptual framework, a description of the relevant background research, and a description of the anticipated strategy for developing and testing new sequences, approaches, structures, and professional development models. Proposers must demonstrate a thorough knowledge of the relevant research literature, how the learning progression chosen for development is fundamental to student learning, and what support structures teachers will need to implement the progressions in classrooms. Projects would receive funding to collect resources, develop capacity, build the theoretical framework for subsequent work, and provide sample student and teacher materials that demonstrate the efficacy of the model.

Products resulting from funded projects must include the following:

- Document(s) that outline the theoretical basis for the proposed process and content strands and explain how the learning progressions, instructional materials modules for students, assessments, professional development models, and professional development materials are consistent with relevant theories of learning and appropriate for the selected grade bands. Research should be cited to establish the importance of the selected learning progressions for addressing critical concepts in science education at the selected grade bands of instruction (K-5, 6-8, or 9-12). The document(s) should be informative to multiple audiences: instructional materials developers; professional development providers; education researchers; and school-based curriculum specialists.

- Instructional materials modules that can support four-to-nine weeks of instruction that spans at least **two grade bands** and that provide structured experiences for students that test the efficacy of this approach. In addition to materials, evidence must be provided that the experiences proposed are reasonable for classrooms and can be implemented within the context of specific STEM content. It is expected that the materials would increase the educational opportunity for all by recognizing and accommodating individual learning styles. A useful resource on this issue can be found on the website of the Center for Applied Special Technology (CAST). (See the reference list.)

  The materials developed under this initiative are intended to be exemplars of new frameworks and should be robust enough to be used by others or become part of published curricula. Proposals must describe how the materials will be made available to developers and others in the scientific and engineering research and education communities, including licensing terms and proposed use of royalties (if any). Merit reviewers will be asked to comment on the efficiency and effectiveness of these arrangements.

- Descriptions of professional development models that provide for the preparation of pre-service and in-service science teachers to work effectively with designated learning progressions that result in effective classroom instruction (Borko, 2004; Loucks-Horsley et al., 2003; Shulman, 2000; Wilson et al., 2001). These models must address professional development needs for both novice and experienced teachers in the content and process knowledge needed for instruction, as well as pedagogical strategies that support working with the instructional modules for students and the underlying science conceptual learning progressions. Funded projects are expected to provide a rich description of the models, sample professional development materials related to the models, and an evaluation of the effectiveness of the professional development implemented with pilot teachers. Proposals must describe how sample instructional modules and the related professional development activities and materials operationalize the models and could be disseminated to the scientific research community, science teachers, writing groups, and policy/reform leaders in science education.

- Instruments appropriate for assessing the approaches and materials developed. These instruments may be original and/or be based on currently available items/instruments (with appropriate permission from the authors). The assessments must be formative, based on a model of learning, and help teachers improve learning (See Pellegrino, Chudowky, and Glaser, 2001; Black, Harrison, Lee, Marshall, and Wiliam, 2002). Assessments must be seamlessly integrated into instruction, provide quality ongoing feedback to teachers about patterns of errors that could indicate the need for modification of instructional strategies, help teachers identify and reconstruct students' misconceptions and provide useful feedback to students. (NRC, 2003).

- Implementation studies that provide results of the pilot study with students in classrooms testing key conjectures establishing the theoretical ideas. It is expected that the research will be based on observations by team members in active classrooms using the materials developed. While pilot testing may be limited to a few classrooms for a relatively short period of time (weeks instead of semesters), the activities conducted in the classroom need to be well documented and include studies of the implementation with observations, audio and videotapes, student artifacts, results of pilot instruments and/or other mechanisms. It is expected that these studies will be published in appropriate journals.

Pending the availability of funding, future solicitations may provide opportunities to seek funding to develop materials for students and teachers for each appropriate grade band providing both a sequence and a hierarchy of activities and learning that culminate in deep and powerful understandings.

Project Description

Proposals will contain the elements listed below, which must be addressed in the Project Description section of the proposal. The project description is limited to **20 pages, single spaced.** The following elements are additional review criteria. These criteria apply to the instructional materials for students as well as the models for professional development and associated professional development materials. For further elucidation of criteria for the professional development materials, see the Teacher Professional Continuum program solicitation (NSF 05-580).

Goals and Objectives. Provide a clear description of the process(es), content area(s), and grade bands that will be part of the project along with specific goals and objectives that the project will meet.

Work Plan. The work plan must address how the five required project products (see above) will be developed over the period of the project. These must include a discussion of the following.

- Evidence that the project is based on clear theoretical foundations, which includes a thorough overview of relevant research and literature to indicate knowledge of disciplinary, pedagogical, and methodological issues.
- Instructional materials developed for students and show how they are based upon the learning progressions across grade bands.
- Models of professional development and accompanying resources for teachers that support models of instruction based on learning progressions.
- Assessment instruments that will be developed and/or modified to measure student outcomes at various stages throughout the learning progression.
- The design of the implementation studies, which must employ appropriate methodologies.

Project Evaluation. Describe the evidence that will be accepted to determine the extent to which the goals are achieved and the activities that will be used to obtain that evidence. Project evaluation covers all critical components of the project, including formative assessment of the conceptualization and development process (which may be conducted by an internal evaluator) and summative evaluation (which must be conducted by an external evaluator) that speaks to factors affecting the quality of the instructional materials modules (relative to content and pedagogical demands), the efficacy of the professional development model, the quality of the professional development resources, the quality of the assessments, and the impact on student outcomes during pilot testing.

Dissemination. Explain how project results will be communicated to professionals and practitioners in STEM education communities both during and after the project and how products (instructional modules for students, resources for teachers, and professional development models) will be shared with or made available to the wider community.

Personnel. Describe the expertise and experience of key personnel. The proposal must include a detailed description of the role and commitment level of each of the key personnel. Project teams are expected to include experts in STEM content, education research, instructional materials and assessment development, and teacher education, as well as practicing teachers and school/district administrators.

Results of prior NSF support. Describe how the results of related prior NSF support for educational projects in which senior personnel have been involved ground and demonstrate the need for the proposed work. In cases where previous projects have resulted in materials related to the proposed work, include a summary of the past project evaluation that provides compelling evidence of the quality and effectiveness of the materials and professional development strategies developed.

INSTRUCTIONAL MATERIALS FOR STUDENTS

Background Information

Proposed instructional materials must exhibit a coherent content framework that is aligned with standards developed by national professional organizations (American Association for the Advancement of Science, 1993; International Technology Education Association, 2000; National Research Council, 1996; National Council of Teachers of Mathematics, 2000); foster inquiry, including critical thinking, problem solving, decision-making, and communication at increasing levels of complexity; and focus on appropriate and important topics at each grade level. Projects must be grounded in recent research on teaching and learning (e.g., Bransford, Brown, & Cocking, 1999; Wiggins & McTighe, 2005) and further an understanding of the connections among STEM disciplines.

Supported projects must be national in scope and significance. These projects should have the potential to enhance student learning and make a significant and noticeable impact on the national market for instructional materials.

Incorporation of instructional technologies should be considered, especially when those technologies are used to provide learning experiences that enhance student understanding. Digital libraries, computational tools, modeling and visualization, virtual environments, connectivity, and communication are among a growing catalog of capabilities that change what and how students can learn. All IMD-funded projects should use instructional technology in appropriate ways, anticipating a future in which these technologies are used widely to enhance education.

The IMD program will support the revision of instructional materials to increase their effectiveness and impact by incorporating significant advances in research on teaching and learning, assessment, use of instructional technologies or in content emphasis. The proposals for the substantial revision of successful IMD-funded materials must provide data on classroom use of the earlier materials. Data such as market share, total number of copies sold or in use, or other pertinent measures, must be cited. Evidence of positive student outcomes, in terms of student achievement, persistence in course taking beyond school, district, or state requirements, and/or other measures must be provided. Documented changes in teacher practice must also be presented. Portions of the materials to be revised (e.g., units, modules) must be identified and a description of the nature of the changes must be given. Any recent revisions, or planned revisions that are not part of the work proposed to NSF, must be described. The relation to such revisions to those proposed for NSF support must be provided and the source of funding for revisions not supported by NSF is to be given. Proposals must provide a clear rationale for the changes being proposed, based on research/studies of the implementation of the materials. Finally, evidence of strong support of the publisher must be included.

Award amounts for the revision of materials that will support one year of instruction vary from $300,000 to $1,000,000 depending on a number of factors, including the extent of the revision, the amount of associated research undertaken, and other resources available. Award amounts for materials that will support instruction of shorter or longer durations will be proportional. Budgets should be discussed with a program officer following receipt of a response to the preliminary proposal and before a full proposal is submitted.

Particularly encouraged are projects that develop and implement research-based instructional materials that ameliorate achievement gaps between student populations and lead to improved understanding of, and participation in, STEM disciplines by members of underrepresented groups. Strategies for ensuring equity and accessibility in materials use and in student learning must be part of the development and implementation process. Proposals must describe specific research-based strategies for engaging target groups and for the rigorous assessment of gains in student achievement.

In addition, when appropriate, the projects should include products designed to help parents understand, and teachers implement, the materials. It is important that projects include strategies and tools to assess the impact of the instructional

materials, particularly on student learning. These data must be based upon credible evidence and be presented in ways that help stakeholders, including teachers, administrators, and parents, make informed decisions about curriculum adoptions.

Project Description

Exemplary proposals will address the following elements in the Project Description section of their proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated in the overall project plan. The project description is limited to **15 pages**, **single spaced**, except for proposals for the development of materials that would support instruction for one year, or more, where the limit is **20 single spaced pages**.

Goals and Objectives. Describe the major goals for the project, as well as the anticipated outcomes for the students and for the teachers.

Project Evaluation. Describe the evidence that will be accepted to determine the extent to which goals are achieved, as well as evaluation strategies that will be used to obtain that evidence. Project evaluation covers all critical components of the project, including formative assessment of the development process (which may be conducted by an internal evaluator) and summative evaluation (which must be conducted by an external evaluator) that speaks to factors affecting implementation, student achievement for a range of student audiences, changes in teacher practice, as well as data and analysis from pilot- and field-test results. The evaluation should embed extensive research efforts to understand better the development process, the effectiveness of the materials in increasing student learning, and changing teacher practice. (Pellegrino, Chudowski, & Glaser, 2001)

The proposal must clearly describe qualifications of the evaluators. In addition, all materials must undergo independent review by qualified experts to ensure accuracy of the content, appropriateness of the pedagogy, and suitability of the contexts, language, etc., for the intended audience. Please note that, for materials that span one or more years of instruction, reviewers of the materials must be selected in consultation with the cognizant NSF Program Officer.

Anticipated Products. Describe the materials to be produced (e.g., print, software, videos, CD-ROMs, scholarly publications, monographs), including the specific learning activities to be developed (experiments, student projects, assessments, etc.).

Rationale. Describe how the proposed materials will broaden the range or improve the quality of materials that address learning goals for students and teachers throughout the nation. The proposer should describe how the instructional materials relate to, and build upon, previous and ongoing efforts in the field. Relevant literature should be referenced to indicate knowledge of disciplinary and pedagogical issues. A search of the ESIE website is recommended.

Content and Pedagogical Strategies. Describe how the materials' content and pedagogical strategies are aligned with standards developed by national professional organizations; how the materials will prepare and motivate students to continue to study STEM at higher grade levels; and how the materials will account for potential differences in students' prior knowledge. Availability of resources (e.g., computers, computer expertise) that will be needed at the school level for implementation of the materials also must be specified. If the materials are supplemental in nature, they must have a clear and limited content focus; utilize scientific, computational, and instructional technologies where appropriate; and demonstrate connections to comprehensive curricula. It is expected that materials will increase the educational opportunity for all students by recognizing and accommodating learner's individual differences. A useful resource on this issue can be found on the website of the Center for Applied Special Technology (CAST). (See the reference list).

Work Plan. Explain how the materials will be created (or revised), reviewed, pilot-tested, field-tested, evaluated, and published. A detailed plan, including a complete timeline that indicates who is responsible for each facet, helps reviewers understand the flow of work. Draft materials must be pilot-tested with master teachers, and field-tests must inform the evaluation of the effectiveness of materials across teachers a range of diverse backgrounds and students of various learning styles and targeted population groups. It is expected that results of these trials will be used to inform revisions of the materials, and that both the results of the trials and the revisions will be submitted to NSF.

Assessment. Describe tools and strategies for student assessment that will be embedded in the instructional materials. It is critical that student assessments be clearly aligned with the desired student learning outcomes and be informed by the nationally developed standards in mathematics, science, and/or technology. Assessments must address both formative and summative aspects of learning. That is, assessments must include strategies for teachers to use during instruction as a guide for making instructional decisions, as well as to determine what students are learning. Development and validation of assessment tools must occur in both the pilot- and field-testing of the materials. To the extent possible, there should be a variety of assessment strategies that are responsive to the different ways that students communicate understanding of content.

Professional Development Resources. Describe the products to be produced (e.g., print, CD-ROM, web-based) that are intended to support teachers and administrators in effectively implementing the materials with fidelity to the developer's intent. Products must include, but not be limited to, teaching guides to accompany the student materials. If the student materials span one or more years of instruction, separate professional development materials must be created to help teachers acquire a deep understanding about the content and pedagogical requirements of the materials. There should be plans for sustaining the use of the professional development materials after the end of the project and for informing teacher educators about the new materials to facilitate incorporation into pre-service teacher education programs. The creation of the professional development materials must meet the guidelines for Teacher Professional Continuum (TPC) program's professional development materials.

Caregiver and Community Involvement. Describe ways to communicate to the community, including school boards and administrators, how the materials are designed to enhance learning of significant subject matter content and to increase student interest in science, mathematics, and technology. Attention should be given to communicating how the materials may differ from those with which community members may be familiar. Further, parent/community materials should assist parents and caregivers in helping their children in STEM education.

Dissemination and Implementation. Explain how information about the materials will be shared with professionals and practitioners in STEM education communities both during and after the project. Instructional materials typically will be published and distributed commercially, although in some instances "free" distribution (e.g., through a refereed and highly visible Web site) might be an appropriate outlet. Proposals should provide a timeline for securing a publisher (or identifying another distribution outlet). This step typically should occur within the first two years of multi-year projects, with distribution outlets firmly established (e.g., through a contract with a publisher or distributor) by the end of the third year of the project. Projects that anticipate generation of potential sales income during the duration of the grant must specify how that income will be used to support the implementation, revision, or continued development of materials.

Personnel. Describe the expertise and experience of the key personnel. The development team must include active participation of practicing scientists, mathematicians, and engineers; cognitive scientists; STEM educators; classroom teachers; curriculum, assessment, evaluation and research experts; technology experts; instructional technologists; and professional developers. The proposal must include a detailed description of the role and commitment level of each of the key personnel.

Results of Prior NSF Support. Describe results of prior NSF support in which senior personnel have been involved that relate to this effort. This description must include evidence of the effectiveness and impact of these related projects.

ASSESSMENT

Background Information

Credible assessment of student learning is critical for determining the effects of education reforms, providing feedback on the instructional materials development process, and understanding the effects and impact of new instructional materials on student learning and achievement. New assessment tools must align with accepted standards, measure specific desirable outcomes of reform, and differentiate the quality of curricula, materials, and instruction. Similarly, schools and districts need support for new types of assessment to document the quality of new instructional materials, to evaluate their effective use, and to assess teacher professional development needs in content knowledge and practice. IMD encourages the development and implementation of new directions in assessing student learning. Assessments may range from those embedded in instructional materials to the creation of items for general use by districts and states.

Assessment projects: (1) are based on current research and include a model of cognition and learning as the cornerstone of the assessment design process (Pellegrino, Chudowski, & Glaser, 2001); (2) provide reliable and valid information that leads to a better understanding of how student learning can be enhanced and how instructional practice can be improved; (3) are developed in collaborative teams with appropriate expertise in the content area, in cognition and learning theory, in assessment development and psychometrics, and instructional practice at appropriate grade levels; and (4) are regional or national in scope.

Assessment projects must address one or more of the following areas:

Student Learning. Assessment focuses on measuring student learning and achievement. Assessment development that focuses both on classroom learning and large-scale tests is needed. These tests must be consistent with standards developed by national professional organizations. Critical areas of need among others include: (a) assessment instruments that focus on key concepts or strands in middle grades mathematics; (b) projects that develop various tools to assess and guide classroom learning and instruction (e.g., embedded assessments); (c) comprehensive science (e.g., middle school science); and (d) assessment in technology education and concept acquisition through project-based learning.

Applications of Technology. Effective applications of technologies for assessment purposes and studies examining unique contributions of various technologies to assessment are encouraged.

Communication Assistance. Materials and strategies may be developed to help schools and districts communicate effectively with teachers, administrators, school board members, parents, and the general community about the role of assessment. Materials and strategies that help the public to be critical consumers of available assessments and assessment results are also welcome.

Project Description

Exemplary proposals will contain the elements listed below, which should be addressed in the Project Description section. Proposal reviewers will examine the extent to which these elements are effectively incorporated in the overall project plan. The project description is limited to **15 pages, single spaced.**

Goals and Objectives. Provide a description of the major goals for the project and for targeted audiences (e.g., students, teachers, general public).

Project Evaluation. Describe the evidence that will be accepted to determine the extent to which the goals are achieved and the activities that will be used to obtain that evidence. An advisory board or external review team with expertise in the content area, STEM education, assessment development, and measurement is recommended to oversee the project. The proposal must provide evidence of the qualifications of the advisory board or review team members.

Anticipated Products. Describe the assessment materials to be produced (e.g., type of assessments, monographs for helping teachers to implement assessments).

Rationale. Provide evidence that the proposed assessment materials meet the needs of students and teachers better than existing ones. The project must be based on clear theoretical foundations and include a thorough overview of relevant research and literature to indicate knowledge of content, learning, cognition, and assessment issues. The proposal must describe how the assessment materials build on, and relate to, previous and on-going efforts in the field, and the contribution they will make to the field of assessment. Searches of the ESIE website as well as the Eisenhower National Clearinghouse (ENC) database are recommended.

Work Plan. Explain how the assessments or materials will be created, reviewed, pilot-tested, field-tested, evaluated, and disseminated. The use of appropriate assessment development methodologies and psychometrically sound evaluations is expected. The proposal must contain a detailed plan of work, including a complete timeline.

Dissemination. Explain how information about the assessments and materials will be shared with professionals and practitioners in STEM education communities both during and after the project. A dissemination plan that projects potential sales income must specify how that income will be used to support the implementation, revision, or continued development of assessment materials.

Personnel. Describe the expertise and experience of the key personnel. It is expected that the assessment development team will include, as appropriate, practicing scientists, mathematicians, and experts in technology; STEM educators; classroom teachers; curriculum developers; and assessment and psychometric-experts. The proposal must include a detailed description of the role and commitment level of each of the key personnel.

Results of Prior NSF Support. Describe results of prior NSF support for related educational projects in which senior personnel have been involved. Proposers who have developed assessments and materials related to the proposed work must include a summary of the past project evaluation that provides compelling evidence of the quality and effectiveness of the materials developed.

APPLIED RESEARCH

Background Information

Applied research studies are intended to demonstrate the effectiveness and impact of efforts to enhance teachers' and students' STEM learning. These studies support a "culture of evidence" for the IMD program that builds a knowledge base about important findings and issues in instructional materials development. (National Research Council, 2002). Knowledge generated by these projects informs program development, project performance, and the field. The insights of teachers, as well as building and/or district-level administrators should provide guidance to researchers in framing their hypotheses, in choosing their tools and methods, and in testing their theories against the realities of the classroom. Research studies are

separate efforts that grow out of a group of completed projects or from questions that arise through analysis of an issue of priority to IMD.

Priority Area

Research Related to Implementation. Proposals are encouraged for research related to adoption and implementation of existing set of instructional materials. Attention must also be paid to organizing, packaging appropriately, and disseminating to schools and other appropriate education agencies the results of the research performed.

Examples of questions that might be addressed include:

What levels of fidelity of implementation of innovative instructional materials are critical in changing student achievement and how can one evaluate the fidelity of implementation?

What are the critical issues that lead to successful adoption, or to unsuccessful adoption efforts?

What are the configurations and combinations in which the materials are used?

What is the nature and amount of teacher professional development required for effective use of the NSF-funded materials?

What are the forces and motivations that are currently driving curriculum change at state and district levels? In particular, what influences are the increased accountability demands in states and districts having on the selection of materials?

Project Description

Exemplary proposals should address the following elements in the Project Description section of the proposal. Proposal reviewers will examine the extent to which these elements are effectively incorporated in the overall project plan. The project description is limited to **15 pages, single spaced**.

Goals and Objectives. Provide clear research questions that address areas of interest fundamental to IMD's mission and goals. Describe how the research methods are appropriate to the question(s) posed.

External Review of Project. Describe how the research will contribute to the knowledge base in the relevant field. An advisory board or external review team with expertise in the content area, STEM education, methodologies (qualitative or quantitative), and measurement is recommended to oversee large, comprehensive projects. The proposal must provide evidence of the qualifications of the advisory board or review team members and describe their role in the project.

Anticipated Products. Describe the materials to be produced (e.g., scholarly publications, monographs). The proposal must provide evidence that the research project has a high likelihood of generating data that will contribute to the cycle of design, research, and redesign of IMD and its project portfolios. Searches of the ESIE website and the Eisenhower National Clearinghouse (ENC) database are recommended.

Rationale. Provide evidence that the project is based on clear theoretical foundations, and include a thorough overview of relevant research and literature to indicate knowledge of disciplinary, pedagogical, and methodological issues. The proposal *must* describe how the research endeavor builds on, and relates to, previous and on-going efforts in the field.

Work Plan. Explain clearly the research design and the methodology to be applied. Explain how the research design provides answers to the research questions. Issues related to internal validity (drawing correct conclusions about the effects of treatment) and external validity (the possibility of generalizing the research findings) of the data generated must be addressed. An explanation of how data will be collected and analyzed and the appropriateness of the methods used must be included.

Dissemination. Explain how research results will be communicated to professionals and practitioners in STEM education communities both during and after the project.

Personnel. Describe the expertise and experience of key personnel. The proposal must include a detailed description of the role and commitment level of each of the key personnel. Project teams must be collaborative in nature, involving those conversant with the relevant research as well as those with experience with developing and implementing instructional materials, with teacher professional development, and with knowledge of the school workplace.

Results of prior NSF support. Describe how the results of prior NSF support for related educational projects in which senior personnel have been involved ground and demonstrate the need for the proposed work. In cases where previous projects have resulted in materials related to the proposed work, include a summary of the past project evaluation that provides compelling evidence of the quality and effectiveness of the materials developed.

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WORKSHOP FOR POTENTIAL PROPOSERS FOR THE LEARNING PROGRESSIONS COMPONENT

In view of the innovative nature of the Learning Progressions component, relative to previous IMD solicitations, NSF is planning a workshop for all who submit preliminary proposals in response to the Learning Progressions component of this solicitation. The primary goals of the workshop are to elucidate the rationale and expectations of this component and to discuss some possible directions related to learning progressions. The workshop will be held at NSF and will include presentations by NSF staff and by researchers knowledgeable about the pertinent issues. The date of the workshop and further details will be provided in responses to preliminary proposals; however, it is expected that the workshop will be held during the second week in January 2006. Details will also be posted on the Division's website: http://www.nsf.gov/div/index. jsp?div=ESIE. Participants are expected to cover their own travel and subsistence expenses.

III. ELIGIBILITY INFORMATION

The categories of proposers identified in the Grant Proposal Guide are eligible to submit proposals under this program announcement/solicitation. An individual may serve as the Principal Investigator (PI) for no more than one proposal per round of competition; any exceptions must obtain prior approval, in writing, from the IMD Section Head.

IV. AWARD INFORMATION

Duration and Funding Level.

Anticipated Type of Award: Standard or Continuing Grant
Estimated Number of Awards: 15-18
Anticipated Funding Amount: $7,000,000, pending availability of funds

The duration of a project is expected to be from two to five years. For **Learning Progressions** the maximum duration of a grant will be 3.5 years and funding will not exceed $3,000,000 for that total period. The level of funding for grants for **Instructional Materials for Students** depends upon the scope of the project. Amounts range from up to $300,000 for the development of a module to several million dollars for development of multiple-year, comprehensive materials. Award amounts for the revision of materials that will support one year of instruction vary from $300,000 to $1,000,000 depending on a number of factors, including the extent of the revision, the amount of associated research undertaken, and other resources available. Budgets should be discussed with a program officer following receipt of a response to the preliminary proposal and before a full proposal is submitted. For **Assessment** projects, the maximum total request of any project may not exceed $1,000,000 per year. For **Applied Research**, the maximum is $500,000 per year.

The funding level for conferences, symposia, and workshops will depend on a number of factors, including the number of participants, duration of the event, etc. Proposers should contact a program officer for further information about funding levels.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required):*

All components of the IMD program listed in this program solicitation require a preliminary proposal for submission of a full proposal. Preliminary proposals must be submitted via FastLane by the specified deadline. Submission of preliminary proposals via FastLane requires completion of the following FastLane forms:

Cover Sheet. Be sure to check the preliminary proposal box.

Project Summary. The abstract must be no longer than 250 words and describe the disciplinary content, the grade level of the audience for the project, the pedagogical strategies to be used, and the IMD component under which the proposal is to be considered. The abstract is used to assign proposals to reviewers. **NOTE**: Proposals in which the Project Summary does not address the two National Science Board merit review criteria, **intellectual merit** and **broader impacts**, in separate statements will be returned without review.

Project Description. This section is limited to six pages. The project narrative must address the following topics: (a) goals or objectives of the project, (b) evidence to be accepted to demonstrate the extent to which the project achieves its goals, (c) anticipated products, (d) need for the project and relevant research, (e) essential features of the project and a work plan that describes how the project will be accomplished, (f) content and pedagogical strategies used, (g) evaluation plans (both formative to inform project development and summative to assess the effectiveness of the project with the target audience), and (h) dissemination plans. Page formats must be single-spaced with a clear and legible type size no smaller than 12-point type and with no less than 2.5 cm margins on all sides.

Budgets. Preliminary proposals should provide an estimated budget for the total amount of money being requested from NSF with information on salaries, equipment (where allowable), participant costs, consultant costs, travel, and indirect costs. The cumulative budget should be entered as the Year 1 budget in FastLane; FastLane automatically creates the cumulative budget. A one-page narrative budget explanation must be included in the Budget Justification section.

Biographical Sketches. Preliminary proposals must provide a brief narrative description of the expertise relevant to the proposed project of key personnel (e.g., educators, researchers, and evaluators) to be involved. Biographical sketches should be complete enough to show that the expertise necessary to conduct the project is available. Sketches should be put in the section of the preliminary proposal for CVs and thus do not become part of the six-page project description.

Supplementary Documents. Appendices and letters of support are **NOT** permitted for preliminary proposals.

Carefully selected reviewers and NSF staff review preliminary proposals. Submission of a full proposal is encouraged or discouraged based upon the reviewers' perceptions of likelihood that a proposal, based on the ideas presented, would be successful in the merit review process for full proposals. *This is an advisory opinion and full proposals may be submitted in either event.* The written response provides information to the proposer to strengthen the proposal. Reviews are returned as expeditiously as possible, but no later than one month prior to the date for submission of a full proposal. Reviews of preliminary proposals submitted for the *Learning Progressions* component will be returned no later than two weeks before the workshop planned for the second week in January 2006. Note: all who submit a preliminary proposal for this component is invited to the workshop, regardless of whether the NSF response encourages or discourages the submission of a full proposal.

Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

The following instructions supplement the *Grant Proposal Guide:*

Cover Sheet. Enter the Preliminary Proposal number. Check the box for "Human Subjects" if applicable.

Project Summary. A one-page Project Summary must be prepared, suitable for publication, which presents a self-contained description of the activity that would result if the proposal were funded. The initial sentences should describe the IMD program component to which the proposal is submitted, the disciplinary content of the project, the grade level of the target audience, and the pedagogical strategies to be used. This information is used to place the proposal in the appropriate review panel. Next, in separate statements the Project Summary must address the ***Intellectual Merit*** and ***Broader Impacts*** of the project. The statement of ***Intellectual Merit*** should include an indication of the need being addressed, a statement of

objectives, methods to be employed, and potential contribution to the advancement of knowledge. The statement of ***Broader Impacts*** should provide a description of the products and outcomes resulting from the project as well as other impacts, such as that on underrepresented groups. The summary should be written in the third person, in the present tense, and should be informative to other persons interested in developing projects or using instructional materials. **NOTE**: Proposals in which the Project Summary does not address the two National Science Board merit review criteria, ***intellectual merit*** and ***broader impacts***, in separate statements will be returned without review.

Project Description (including results from prior NSF support). The Project Description presents most of the information that determines whether or not a grant will be awarded. It must be written to respond to criteria provided in the section on each component. Reviewers will use this information in judging the merit of the proposal as described in this document. In addition, it must communicate potential project impact and general project characteristics. The maximum number of pages allowable for the *Project Description* is 15 pages, with the following exceptions: planning and conference grant proposals must be no longer than 10 pages in length, including visual materials (e.g., charts, graphs, maps, photographs, and other pictorial presentations); proposals for Learning Progressions and for comprehensive, multi-year curricular materials may be up to 20 pages in length. Page formats must be single-spaced with a clear and legible type size of no smaller than 12-point type and with no less than 2.5 cm margins on all sides. See the section *Supplementary Documents* below, and individual program sections for any exceptions to this limitation.

Results from Prior Support. If the prospective PI or a coPIs received support for related NSF activities within the past five years, a description of the project(s) *and* outcomes must be provided in sufficient detail to enable reviewers to assess the value of results achieved. Past projects must be identified by NSF award number, funding amount, period of support, title, summary of results, and a list of publications and formal presentations that acknowledge the NSF award (do not submit copies of the latter). Evaluation data should be clearly described. Details regarding evaluation data should be put into an appendix. PIs must have submitted a final report for any completed NSF-funded project before a new grant may be awarded.

References Cited. Any literature cited should be specifically related to the proposed project, and the *Project Description* should make clear how each reference has played a role in the motivation for or design of the project.

Supplementary Documents. Reviewers are often asked to read and assess a substantial number of competing proposals. For this reason, the *Project Description* alone must provide sufficient information so that a reviewer unfamiliar with the context of the project can make an informed judgment. It may be critical to convey more detailed information to demonstrate levels of competence or expertise, to document commitment of personnel or other resources, to demonstrate the quality of instructional materials, or to provide details of the evaluation of previously developed materials. Such material can be included in appendices that are clearly referenced in the proposal. Appendices, except sample materials, are limited to 20 pages and should be uploaded into the *Supplementary Documents* section on FastLane. Additionally, the proposal may refer to Web Sites that contain this type of supplementary material. Presentation of such materials should be thoughtful and concise. **Reviewers are not required to read appendices or visit referenced websites**.

Proposals for the development of student materials should include examples of the proposed materials and samples of past relevant work. These sample materials should be sent directly to the program, clearly labeled with the proposal number. If the materials are to be sent to the reviewers, at least ten copies are needed. Prospective PIs are encouraged to contact NSF Program Officers if they have questions about submission of appendix materials.

Budgetary Information. Proposals must contain a budget for each year of requested support. The proposal may request funds under any budget category so long as the item is considered necessary to perform the proposed work and is not precluded by program guidelines or applicable cost principles. All budget requests must be documented and justified in the Budget Justification section of no more than three pages. Ordinarily, no funds are made available for equipment or facilities or for continued operational expenses. (See also Section V.B below.) Estimates of calendar months of activity must be reported for categories of key personnel.

Special Proposals: Proposals for Conferences, Symposia, and Workshops. IMD may support a few well-focused conferences or workshops whose products inform the community. Proposers should contact a program officer before submitting proposals for such events.

Proposers are reminded to identify the program announcement/solicitation number (05-612) in the program announcement/ solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required by NSF in proposals submitted under this Program Solicitation.

Other Budgetary Limitations:

The majority of IMD project costs support personnel time and personnel-related costs. Modest requests to support acquisition of materials, supplies, equipment, and computing services are allowable. Grantees are expected to have the computing facilities, most of the equipment, and the physical environment to achieve project goals. IMD will not fund the purchase of classroom equipment necessary to pilot, field-test, or implement instructional materials. IMD does not support the publication of student instructional materials for distribution.

C. Due Dates

Proposals must be submitted by the following date(s):

Preliminary Proposals *(required):*

      November 14, 2005

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

      March 13, 2006

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: http://www.fastlane.nsf.gov

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 (NSB 97-72). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued Important Notice 127, Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the Grant Proposal Guide Chapter III.A for further information). The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which he/she is qualified to make judgments.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

NSF staff will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria:
In addition to the Foundation-wide criteria described above, special criteria to be used in evaluating proposals submitted under each of the four IMD components (learning progressions, instructional materials for students, assessment, and applied research) are described for each component under the Project Description subsection of Section II, Program Description. Under the criterion of **intellectual merit**, reviewers will address goals and objectives, project evaluation, anticipated products, rationale, work plan, content and pedagogical strategies, assessment, and personnel. Under the criterion of **broader impacts**, reviewers will address strategies for increased participation of underrepresented groups, professional development, caregiver and community involvement, and dissemination and implementation. Some of the goals and products may be addressed under *broader impacts*, as well

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

NSF is striving to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation, or the date of proposal receipt, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/. Paper copies of these documents may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at http://www.gpo.gov.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

In addition to the standard reporting requirements, PIs will be required to submit regular information regarding the status of their projects. This will include information about participants, activities undertaken, and project outcomes.

Annual Reports. Annual reports should highlight major accomplishments, describe the lessons learned, document alignment with the proposed time line, and describe the status of the development of the materials. Samples of completed materials, or drafts of materials, should be included.

Site Visitor. For Instructional Materials for Students awards and Assessment awards, the PI and the NSF Program Officer may agree on a site visitor who reviews the progress of the project and its evaluation annually and reports to both the Principal Investigator and to the NSF Program Officer.

Final reports/materials submission.

Approximately 30 days before the award expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Two complete sets of materials must be submitted to IMD at the time of the submission of the final report. If materials are not in the final, published form when the final report is submitted, two published copies must be submitted to IMD as soon as they become available. One published copy must also be submitted to the Eisenhower National Clearinghouse (ENC) (ENC, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210-1079; email: submit@enc. org). At any time, IMD staff may request interim drafts of materials for review.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project reporting system, available through FastLane, for preparation and submission of annual and final project reports. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- John (Spud) Bradley, Section Head, IMD, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5091, fax: (703) 292-9044, email: jbradley@nsf.gov
- Janice M. Earle, Senior Program Director, Directorate for Education & Human Resources, Division of Research, Evaluation & Communication, 885 S, telephone: (703) 292-5097, fax: (703) 292-9044, email: jearle@nsf.gov
- Michael R. Haney, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5102, fax: (703) 292-9044, email: mhaney@nsf.gov
- David Hanych, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5124, fax: (703) 292-9044, email: dhanych@nsf.gov
- David C. Royster, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5127, email: droyster@nsf.gov
- Gerhard L. Salinger, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 S, telephone: (703) 292-5116, fax: (703) 292-9044, email: gsalinge@nsf.gov
- Robert D. Sherwood, Program Director, Directorate for Education & Human Resources, Division of Elementary, Secondary, & Informal Education, 885 N, telephone: (703) 292-5115, fax: (703) 292-9044, email: rsherwoo@nsf.gov

For questions related to the use of FastLane, contact:

- ESIE FastLane Help, email: ehr-esi-fl@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each

chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF Website at http://www.nsf.gov/home/ebulletin, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's MyNSF News Service (http://www.nsf.gov/mynsf/) to be notified of new funding opportunities that become available.

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

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The Division of Elementary, Secondary, and Informal Education also has programs in Teacher Professional Continuum (TPC - co-managed with DUE), Informal Science Education (ISE), Centers for Learning and Teaching (CLT), Information Technology Experiences for Students and Teachers (ITEST), Advanced Technological Education (ATE - co-managed with DUE), and Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST). Brief descriptions and solicitations for these programs can be found at http://www.nsf.gov/div/index.jsp?div=ESIE.

There are programs in other EHR Divisions that also may be of interest to proposers to IMD:

The Division of Undergraduate Education (DUE) has programs in Advanced Technological Education (ATE), Assessment of Student Achievement in Undergraduate Education (ASA); Course Curriculum and Laboratory Improvement (CCLI); and the National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL). Brief descriptions and solicitations for these programs can be found at http://www.nsf.gov/div/index.jsp?div=DUE.

The Division of Research, Evaluation and Communications has programs in Evaluative Research and Evaluation Capacity Building (EREC), Research on Learning and Education (ROLE), and the Interagency Education Research Initiative (IERI). Brief descriptions and solicitations for these programs can be found at http://www.nsf.gov/div/index.jsp?div=REC.

The Division of Graduate Education has the program for the Graduate Teaching Fellowships in K-12 Education (GK-12). A brief description and the solicitation for this program can be found at http://www.nsf.gov/div/index.jsp?div=DGE.

Information and the solicitation for the Math and Science Partnership program (MSP) can be found at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5756&org=NSF.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or

equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- **Location:**   4201 Wilson Blvd. Arlington, VA 22230

- **For General Information**   (703) 292-5111
  (NSF Information Center)**:**

- **TDD (for the hearing-impaired):**   (703) 292-5090

- **To Order Publications or Forms:**

        Send an e-mail to: pubs@nsf.gov

        or telephone: (703) 292-7827

- **To Locate NSF Employees:**   (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

OMB control number: 3145-0058.