EDUCATION AND HUMAN RESOURCES $790,410,000

The FY 2009 Budget Request for the Directorate for Education and Human Resources (EHR) is $790.41 million, an increase of $64.81 million, or 8.9 percent, over the FY 2008 Estimate of $725.60 million.

Education and Human Resources Funding
(Dollars in Millions)

|	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate Amount	Percent
Research on Learning in Formal and Informal Settings (DRL)	$208.99	$214.00	$226.50	$12.50	5.8%
Undergraduate Education (DUE)	204.96	211.05	219.83	8.78	4.2%
Graduate Education (DGE)	155.90	160.10	190.70	30.60	19.1%
Human Resource Development (HRD)	125.80	140.45	153.38	12.93	9.2%
Total, EHR[1]	$695.65	$725.60	$790.41	$64.81	8.9%

Totals may not add due to rounding.

[1] Excludes $145.94 million in FY 2007 obligations and an estimated $100.0 million in FY 2008 and FY 2009 receipts from H-1B Nonimmigrant Petitioner Fees.

NSF, in accordance with the NSF Act of 1950, is the principal federal agency charged with promoting science and engineering (S&E) education. In support of this mission, EHR promotes the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators and a well-informed citizenry who have access to the ideas and tools of science and engineering. EHR supports education, research, and infrastructure development in all S&E disciplines. The purpose of these activities is to enhance the quality of life of all citizens and the health, prosperity, welfare, and security of the Nation and to build the science, technology, engineering, and mathematics (STEM) workforce of the 21st century.

EHR Subactivity Funding
(Dollars in Millions)
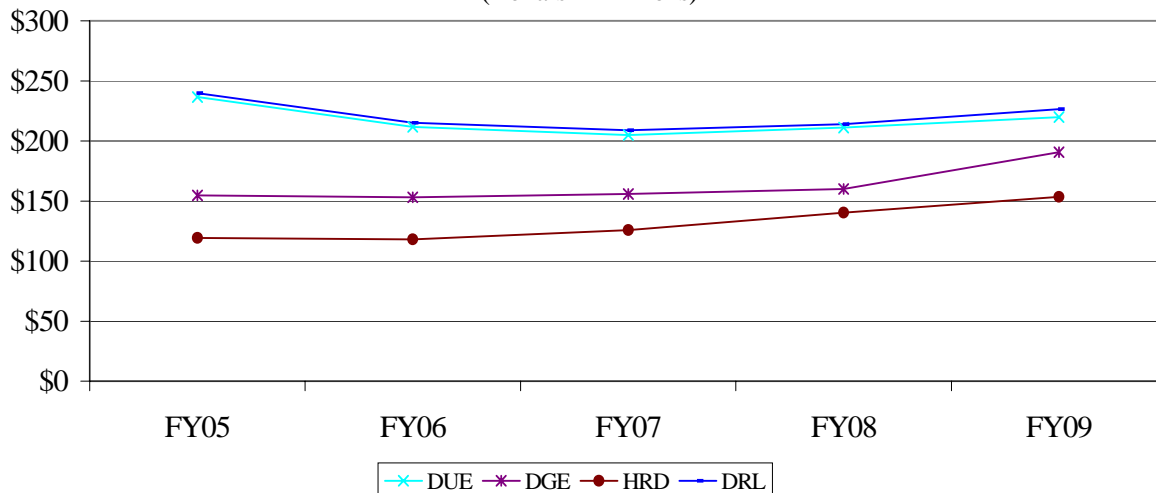
EDUCATION AND HUMAN RESOURCES

Appropriation Language

For necessary expenses in carrying out science and engineering education and human resources programs and activities pursuant to the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-1875), including services as authorized by 5 U.S.C. 3109, authorized travel, and rental of conference rooms in the District of Columbia, ~~$725,600,000,~~*$790,410,000,* to remain available until September 30, ~~2009.~~*2010. (Science Appropriations Act, 2008.)*

Education and Human Resources
FY 2009 Summary Statement
(Dollars in Millions)

	Enacted/ Request	Carryover/ Recoveries	P.L. 110-161 Rescission	Total Resources	EPSCoR	Expired	Adj. Total Resources	Obligations Incurred/Est.
FY 2007 Appropriation	$796.69	$1.50	-	$798.19	-$102.11	-$0.33	$695.75	$695.65
FY 2008 Estimate	725.60	0.10	-0.10	725.60	-	-	725.60	725.60
FY 2009 Request	790.41	-	-	790.41	-	-	-	790.41
$ Change from FY 2008								$64.81
% Change from FY 2008								8.9%

Totals may not add due to rounding.

Adjustments to Base

In FY 2007, $102.11 million is being reported for EPSCoR in the Integrative Activities activity within the R&RA appropriation. The EHR FY 2009 Summary Statement table excludes EPSCoR from FY 2007 through FY 2009.

Explanation of Carryover

Within the Education and Human Resources (EHR) appropriation, a total of $99,331.14 was carried forward into FY 2008. This amount is rescinded, per P.L. 110-161.

RELEVANCE

NSF's EHR Directorate is the principal source of federal support for strengthening S&E education through education research and development (R&D). EHR programs support technological innovation to enhance economic competitiveness and new job growth, address the workforce needs of the Nation, and help ensure a scientifically literate population and a robust pool of talented experts.

EHR activities strengthen U.S. education at all levels to support continued U.S. economic and research preeminence. These activities are relevant to the following need expressed in the President's American Competitiveness Initiative (ACI):

"Education is the gateway to opportunity and the foundation of a knowledge-based, innovation-driven economy. For the U.S. to maintain its global economic leadership, we must ensure a

continuous supply of highly trained mathematicians, scientists, engineers, technicians, and scientific support staff as well as a scientifically, technically, and numerically literate population."

EHR's programs seek to attract and retain people in STEM fields, increasing the Nation's ability to compete for and keep highly-skilled American workers. The programs do so by:
- promoting cooperation among academic institutions, industry, and government;
- encouraging the sharing of STEM resources and knowledge of critical skills needed by employers;
- supporting robust R&D on effective STEM education practices that increase retention of STEM students and teachers, and increase their content knowledge;
- broadening participation of underrepresented groups, geographic regions, and types of institutions in all S&E fields;
- providing scholarships and fellowships to graduate and undergraduate students in STEM fields; and
- recognizing outstanding efforts in STEM education and mentoring.

The FY 2009 Budget Request includes programs that support efforts to prepare a diverse, globally-engaged workforce and strengthen K-12 STEM education by enhancing our understanding of how students learn and applying that knowledge to train highly qualified teachers, develop effective curricular materials, and improve student learning.

To continue its national leadership in STEM research, policy and practice, in FY 2009 EHR will emphasize five thematic priorities: Broadening Participation to Improve Workforce Development; Enriching the Education of STEM Teachers; Furthering Public Understanding of Science and Advancing STEM Literacy; Promoting Cyber-enabled Learning Strategies to Enhance STEM Education; and Promoting Learning through Research and Evaluation. These thematic areas encourage the community to identify commonalities of purpose and characteristics that link across numerous programs. The thematic structure then emphasizes synergistic work among programs. The synergy will promote linkages and discussions among various stakeholder groups; advance our knowledge base in terms of breadth, depth and coverage; ensure a systematic response to national issues in STEM education; and help define NSF's strategic leadership in STEM education for the next several years.

Broadening Participation to Improve Workforce Development
A key component of this thematic priority is Innovation through Institutional Integration. Connectivity, integration, and synergy are keys to discovery and innovation. In both research and education, it is the forging of new links between ideas or methodologies that were previously disparate that paves the way for innovation. The innovation path can also be paved through new alliances and partnerships that integrate research and education, broaden participation, and attend to the critical educational junctures that often impede academic and career pursuits in STEM disciplines and thereby limit the capacity of the Nation's STEM workforce. These efforts will better enable higher education institutions to infuse these ingredients of a vibrant, 21st century STEM workforce into the fabric of their institutions.

This effort will also support greater intra-institutional and inter-institutional collaboration and synergy across NSF-funded projects from among selected flagship programs. These include those designed to broaden participation (e.g., LSAMP, including Bridge to the Doctorate; AGEP; CREST; ADVANCE; GSE; RDE), integrate research and education (e.g., IGERT, REU, including a new effort to expand REU to community colleges, CC-REU]), address critical junctures (MSP; Noyce; ATE; STEP), and increase the relevant knowledge base surrounding these issues (REESE). It will support student research experiences; adaptive learning experiences; cyber-enabled learning activities that promote integration and synergy; international experiences, and innovative curricula activities. This effort is expected to better integrate existing activities and lead to innovative institution-wide benefits.

Investments in this thematic priority support EHR's graduate education efforts. For example, the Bridge to the Doctorate component of LSAMP has enhanced its linkages with AGEP sites, providing opportunities for students to easily progress from undergraduate to graduate level STEM education. The ADVANCE program makes graduate education connections, as female talent from this level flows into faculty positions.

Enriching the Education of STEM Teachers

EHR proposes a new research and development thematic priority – *Teacher Education in STEM: Enriching Knowledge and Practice.* It is designed to advance knowledge and practice in the preparation of K-12 STEM teachers and to encompass the entire continuum – from pre-service education, to induction, to continuing professional development. The effort will help NSF meet the teacher preparation goals of the American Competitiveness Initiative (ACI), which stress the criticality of replacing the Nation's aging teacher corps, reducing attrition of STEM teachers, and broadening participation in STEM teaching.

This integrative effort is grounded in research and practice, builds on current knowledge while addressing critical issues and gaps in teacher education, and expands current and prior efforts to enable STEM teacher learning. It will address a number of objectives, including assuring that our Nation's K-12 teachers are:

- proficient in STEM concepts and topics;
- confident in their own grasp of STEM content;
- life-long learners of this content;
- aware of rapidly changing STEM disciplinary content;
- able to guide and assess STEM learning in age-appropriate ways;
- confident in the use of cyber-enabled tools;
- prepared to engage an increasingly diverse student population; and
- supported by STEM faculty, in collaboration with teacher education faculty and practitioners.

All of these objectives require a research knowledge base about STEM teacher learning that will serve as a foundation for improved models of teacher education.

A rigorous evaluation component, both at the project level as well as program-wide, will measure outcomes in terms of increased production of well-qualified teachers; knowledge and dissemination of proven strategies that contribute to this production; and evidence of a relationship between teacher education components and improved K-12 student learning. Research questions will address new areas of national importance concerning teacher preparation, induction, and professional development.

Furthering Public Understanding of Science and Advancing STEM Literacy

This thematic priority engages the full spectrum of research in STEM education, as well as translational research and development to bring science to learners of all ages and in all settings. It blends research at the frontiers of STEM with research at the frontiers of learning. STEM literacy is supported by improving STEM teaching and learning in the K-12 domain through cutting-edge educational research about learning, development of models and instructional tools for teachers and students, and the enrichment of teachers' learning of STEM content. Public understanding of science is advanced in informal learning settings through research-based and innovative exhibitions, films, television and radio series, cyber-enabled learning tools, citizen science programs, dialogues between scientists and the public, and youth and community initiatives about the content, processes and social impacts of STEM.

Promoting Cyber-enabled Learning Strategies to Enhance STEM Education
NSF has the distinctive capacity to link technological and computational innovators with domain scientists, learning specialists, and social/behavioral analysts for enhancing learning across the STEM disciplines broadly.

A distinctive feature of this thematic priority is the access it would give teachers, not only to their peers but to STEM specialists and to the knowledge about teaching and learning that those specialists continue to generate. In fact, through the National Science Distributed Learning (NSDL) NSF has gained significant experience in enhancing access of teachers to high quality teaching materials and resources. In terms of students in rural districts and low-income communities, they can gain access to advanced placement courses, often missing locally. The community of researchers has conveyed its strong commitment to a program of inquiry that examines the conditions under which cyberinfrastructure promotes STEM teaching and learning.

Key components of this thematic priority are the Federal Cyber Service: Scholarship for Service (SfS) program, NSDL, and the Innovative Technology Experiences for Students and Teachers (ITEST) program.

Promoting Learning through Research and Evaluation
Support for research and evaluation efforts will begin to enable us to develop NSF-wide evaluation efforts. Program evaluation, well established within EHR, is now being expanded Foundation-wide to cover all elements in NSF's STEM education portfolio. EHR will provide leadership – within NSF and across the STEM-centered federal agencies – to promote evaluations and to encourage programming that will improve both outcomes and opportunities for scalability. Such leadership requires the selection of evaluation methodologies that are appropriately matched to the question asked, the context of the activity, and the stage of development of the project and the world of practice that surrounds it. EHR will continue to adhere to rigorous evidence-based approaches, using multiple methods to evaluate our STEM education programs to determine the success and impacts of our investment and to advance the STEM education knowledge base. Our evaluation efforts will be tailored to the stage of the project, and will vary in duration, but frequently will be multi-year with annual reports on progress. We will continue to draw on the expertise of external evaluators in concert with that found within the agency. Likewise, we will continue to use the results of the programs to redirect, realign or consolidate activities, and/or enhance directions.

Summary of Major Changes by Division   *(Dollars in Millions)*

FY 2008 Estimate, EHR………..….…………….………………………………...…............…$725.60

Research on Learning in Formal and Informal Settings (DRL)   +$12.50
  FY 2009 funding emphasizes improving STEM teaching and learning in the K-12 domain through cutting-edge research and development. The FY 2009 Request includes funding increases of $8.50 million for the Discovery Research K-12 program; $3.0 million for Project and Program Evaluation; and $1.0 million for Informal Science Education. Support for Research and Evaluation on Education in Science and Engineering is equal to the FY 2008 Estimate.

Undergraduate Education (DUE)   +$8.78
  To further strengthen NSF's emphasis on increasing the quality and quantity of the science and engineering workforce, and the extent to which undergraduate students are well prepared for an increasingly technological global society, EHR will increase funding for most DUE programs.

The FY 2009 Request includes funding increases of $3.50 million for the Federal Cyber Service: Scholarship for Service program; $2.50 million for the NSF Math and Science Partnership program; $1.71 million for the Course, Curriculum, and Laboratory Improvement program; $800,000 for the Robert Noyce Teacher Scholarship Program; and $250,000 for the National Science Distributed Learning program (formerly the National STEM Education Digital Library program); and $20,000 for the Excellence Awards in Science & Engineering program. Funding for the Advanced Technological Education program and the STEM Talent Expansion Program is level with the FY 2008 Estimate.

Graduate Education (DGE)   +$30.60

EHR funding for the Graduate Research Fellowship program will increase by $28.60 million over the FY 2008 Estimate, supporting an additional 700 graduate students. EHR funding increases by $2.0 million for the Graduate Teaching Fellows in K-12 Education program, supporting an additional 45 students. EHR funding for the Integrative Graduate Education and Research Traineeships program is level with FY 2008. All three of these programs also receive support through the Research and Related Activities appropriation.

Human Resource Development (HRD)   +$12.93

The FY 2009 Request includes increases of $5.53 million for the Centers of Research Excellence in Science and Technology program; $2.0 million for the Louis Stokes Alliances for Minority Participation program; $1.40 million for the Alliances for Graduate Education and the Professoriate program; $1.25 million for the Research on Gender in Science and Engineering program; $1.0 million for the Historically Black Colleges and Universities Undergraduate Program; $750,000 for ADVANCE; $500,000 for the Research in Disabilities Education program; and $500,000 for the Tribal Colleges and Universities Program.

Subtotal, Changes   +$64.81

FY 2009 Request, EHR …………………….…………………………………………........$790.41

Summary of Major Changes in Directorate-wide Investments   ***(Dollars in Millions)***

FY 2008 Estimate, EHR…………..………..……………………………………….............…..$725.60

Discovery   +$13.36

Discovery Research K-12 (DR-K12; +$8.50 million to $108.50 million).
DR-K12 investments will broaden participation in the S&E enterprise through the development of more effective tools and resources for teachers and students that will support inquiry-based classroom practices and a more intensive scientifically-based assessment of the efficacy of these resources. The increase in DR-K12 will address the broad recognition that teacher education in STEM is critical to the Nation's future and ensure that teachers know how to guide and assess the learning of STEM content in age-appropriate ways, using available tools and resources. Of the DR-K12 increase, $3.70 million will support the new EHR thematic priority, Teacher Education in STEM: Enriching Knowledge and Practice (see fuller description above).

Centers of Research Excellence in Science and Technology (CREST; +$5.53 million to $30.53 million).
In support of the thematic priority of Broadening Participation to Improve Workforce

Development: Innovation through Institutional Integration, $2.10 million of CREST's increase will be directed to this effort. CREST's increase will be used to support an additional CREST award, 2 to 4 additional projects in the HBCU-RISE activity, up to 10 additional partnership supplements for the existing portfolio, and/or up to 12 additional SBIR/STTR diversity collaborations with industry partners co-funded with the Directorate for Engineering. Some combination of these award types is expected based on the most meritorious proposals received. This increase will support greater intra-institutional and inter-institutional collaboration and synergy including increased efforts designed to broaden participation.

The total funding change for the Discovery Strategic Outcome Goal also reflects a change in the Stewardship offset.

<u>Learning</u>   +$48.81

Teacher Education ($10.0 million total).
   Under the Teacher Education thematic priority FY 2009 increases include:

- *Math and Science Partnership (MSP) program (+$2.50 million overall; $1.0 million for Teacher Education).* The most recent study of the MSP program followed more than 300 schools participating in partnerships whose funding began during the program's second year. Results showed that students' performance on annual math and science assessments improved in almost every age group when their schools were involved in a program that linked K-12 teachers with their colleagues in higher education. The planned increase for MSP will address critical junctures in the educational experience through support for several additional partnerships, including new Teacher Institutes for the 21st century.

- *Robert Noyce Teacher Scholarship Program (Noyce; +$800,000 to $11.60 million).* Funding for Noyce will support a continued effort enabling more institutions to develop and implement programs to prepare STEM undergraduate majors and STEM professionals to become K-12 science and mathematics teachers.

- *Graduate Teaching Fellows in K-12 Education (GK-12; +$2.0 million to $49.0 million).* Funding for the Graduate Teaching Fellows in K-12 Education (GK-12) will support an additional 45 graduate fellows and up to 4 pilot projects linking GK-12 with community colleges in EPSCoR states.

- *Louis Stokes Alliances for Minority Participation (LSAMP; +$2.0 million to $42.50 million).* This will support up to 2 additional AMPs and/or up to 2 new sites for Bridge to Teaching awards. LSAMP expands participation of underrepresented minorities in STEM fields, including the field of STEM teaching.

- *Tribal Colleges and Universities Program (TCUP; +$500,000 to $13.35 million).* This increase will support up to two additional implementation awards which would include either a STEM Teachers of Excellence Education Project (STEEP) or a Phase II project from an institution that has already received a TCUP award. Additionally, the program will support a pilot effort to increase the participation in, and the scope of, individual undergraduate, placed-based research projects at several TCUP colleges. This design will be informed by the NSF Research Experiences for Undergraduates (REU) program, but it

will target Tribal College and University students and STEM faculty working at their home institutions.

- An additional $3.70 million integral to this Teacher Education thematic priority is from the Discovery Research K-12 program (shown under Discovery). The National Science Distributed Learning (NSDL) program (shown under Research Infrastructure) and the Course, Curriculum and Laboratory Improvement program (shown below) will provide expertise to enhance the awards made relating to this thematic priority.

Broadening Participation to Improve Workforce Development: Innovation through Institutional Integration ($10.0 million total).

Program increases that contribute to the funding towards Innovation through Institutional Integration are as follows:

- *Centers of Research Excellence in Science and Technology (CREST; +$5.53 million; $2.10 million towards the Innovation through Institutional Integration effort).* The increase will support greater intra-institutional and inter-institutional collaboration and synergy including increased efforts designed to broaden participation. The full increase for CREST is described in the Discovery section above.

- *Historically Black College and Universities – Undergraduate Program (HBCU-UP; +$1.0 million to $31.0 million).* Additional HBCU-UP funds will support 4 to 8 new HBCU/STEM teacher development projects to increase the numbers of highly-prepared teachers through program tracks currently in place (Implementation, Targeted Infusion, and Education Research).

- *Alliances for Graduate Education and the Professoriate (AGEP; +$1.40 million to $16.75 million).* AGEP will support activities that focus on critical junctures into the professoriate including promoting national networking for the current AGEP community and increasing leveraging opportunities to advance careers of minority doctoral recipients.

- *Research on Gender in Science and Engineering (GSE; +$1.25 million to $11.50 million).* Additional funds will support two additional research-based innovation projects, which aim to inform practitioner communities about new advances in education research that enable more girls and young women to pursue STEM education and careers.

- *Research in Disabilities Education (RDE; +$500,000 to $6.50 million).* RDE will support an additional Focused Research Initiative award, which will use a quasi-experimental approach to investigate evidenced-based practices for preparing science and math educators to teach students with disabilities effectively.

- *ADVANCE. (+$750,000 to $1.25 million).* Funds will be used to forge relevant institutional linkages with other broadening participation efforts and to support value-added international activities to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse STEM workforce.

The *Math and Science Partnership (MSP)* program will support the Innovation through Institutional Integration effort at a level of $1.50 million and the *Robert Noyce Teacher Scholarship Program (Noyce)* will provide $1.0 million for this effort.

Broadening Participation to Improve Workforce Development: Graduate Fellowships and Traineeships.

In addition to emphasizing broadening participation to improve workforce development, production of a robust scientific education community is an EHR priority; therefore, an increase in graduate education funding is central to this Request. Funding for the Graduate Research Fellowship program increases by $28.60 million in EHR, supporting an additional 700 fellows. The increase of $2.0 million for GK-12 is described above. Funding will remain equal to the FY 2008 Estimate for Integrative Graduate Education and Research Traineeships (IGERT).

Promoting Learning through Research and Evaluation.
- *Project and Program Evaluation (+$3.0 million to $10.0 million).* Additional funds will be used to support thematic STEM evaluation projects designed to enhance scientific workforce development and for collaborations that involve advanced learning technologies in science and engineering using cyberinfrastructure.

- *Course, Curriculum and Laboratory Improvement (CCLI; +$1.71 million to $39.21 million).* Additional funds in CCLI will support up to seven additional Phase 1 Projects allowing faculty members to pilot and evaluate new instructional and pedagogical approaches for improving the quality of undergraduate STEM education and the retention of students in these fields and to improve the quality of undergraduate education.

Promoting Cyber-enabled Learning Strategies to Enhance STEM Education.
- EHR's Federal Cyber Service: Scholarship for Service (SfS) program is increased by $3.50 million to $15.0 million to augment support for building a cadre of federal professionals with skills required to protect the Nation's critical information infrastructure.

- Fundamental to EHR's efforts on cyber-enabled learning are the National Science Distributed Learning (NSDL) program (shown under Research Infrastructure) and the Innovative Technology Experiences for Students and Teachers (ITEST) program (see p. EHR-26).

Furthering Public Understanding of Science and Advancing STEM Literacy.
- Informal Science Education *(ISE; +$1.0 million to $66.0 million).*
  ISE will expand its Communicating Research to Public Audiences program, by increasing award size to $100,000 and the number of awards to 15, to enable NSF-funded researchers to share their work with the public through exhibits, media, programs, and other deliverables developed in collaboration with informal education organizations such as science museums.

The total funding change for the Learning Strategic Outcome Goal also reflects a change in the Stewardship offset.

Research Infrastructure   +$0.25

Promoting Cyber-enabled Learning Strategies to Enhance STEM Education
- The name of the National STEM Education Digital Library program is proposed to be changed to National Science Distributed Learning (NSDL) to better align with our strategic goals. NSDL funding increases by $250,000 to $16.50 million.

Stewardship   +$2.39

A number of activities are funded directly from NSF's programs to advance NSF's Stewardship goal. These include Intergovernmental Personnel Act appointments, NSF-wide studies and evaluations, and mission-related information technology investments. As is discussed further in the Stewardship chapter of this Request, in FY 2009 NSF has realigned IT investments to tie mission-related activities more directly to NSF's programs.

Subtotal, Changes   +$64.81

FY 2009 Request, EHR ………..…………………………………………………...........$790.41

NSF-WIDE INVESTMENTS

In FY 2009, the Directorate for Education and Human Resources will support research and education efforts related to broad, Foundation-wide investments in a number of areas, including the Administration's interagency R&D priorities.

EHR NSF-wide Investments
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate	
				Amount	Percent
Cyber-enabled Discovery and Innovation (CDI)	-	$3.00	$4.87	$1.87	62.3%
Cyberinfrastructure	17.74	16.25	16.50	0.25	1.5%
International Polar Year	2.45	2.00	-	-2.00	-100.0%
Mathematical Sciences	1.15	-	-	-	N/A
National Nanotechnology Initiative	3.27	3.10	3.10	-	-
Networking and Information Technology R&D	3.91	9.00	9.50	0.50	5.6%

Cyber-enabled Discovery and Innovation (CDI): EHR's CDI support totals $4.87 million, an increase of $1.87 million, to study the impact of information technology on educational practice, new approaches to using technology in education, application and adaptation of technologies to promote learning, the effects of technology on learning.

Cyberinfrastructure (CI): EHR's Cyberinfrastructure support totals $16.50 million, an increase of $250,000, and funds the National Science Distributed Learning program, an online network of learning environments and resources for STEM education at all levels in both formal and informal settings.

International Polar Year (IPY): With the conclusion of IPY in March 2009, key components of this investment will be retained for core programs.

Mathematical Sciences: With the conclusion of this priority area in FY 2007, key components of this investment will be retained for core programs.

National Nanotechnology Initiative (NNI): FY 2009 NNI support totals $3.10 million, the same as the FY 2008 Estimate. It will provide continuing support for nanoscience education activities.

Networking and Information Technology Research and Development (NITRD): FY 2009 support for NITRD totals $9.50 million, an increase of $500,000. This provides continuing support for information technology education activities and for the Cyber-enabled Discovery and Innovation investment.

Additional detail may be found in the NSF-wide Investment chapter.

QUALITY

EHR maximizes the quality of the research and education it supports through the use of a competitive, merit-based review process. Project evaluation is required, with projects reporting their progress and impact through annual and final reports to NSF. In addition, external program evaluations are conducted for EHR-managed activities.

To ensure the highest quality in processing and recommending proposals for awards, EHR convenes Committees of Visitors, composed of qualified external evaluators, to review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of NSF's investments. In FY 2007 COVs were held for the following programs: Scholarship for Service/Cybercorps, Historically Black Colleges and Universities – Undergraduate program, Tribal Colleges and Universities program, Teacher Professional Continuum, Louis Stokes Alliances for Minority Participation, Alliances for Graduate Education and the Professoriate, and Centers of Research Excellence in Science and Technology.

In FY 2008 COVs are planned for Graduate Teaching Fellowships in K-12 Education, Integrative Graduate Education and Research Traineeships, Informal Science Education, Information Technology Experiences for Students and Teachers, Math and Science Partnership, National STEM Education Digital Library, and the Robert Noyce Scholarship Program. In FY 2009 COVs are planned for the following programs: Research in Disabilities Education, Research on Gender in Science and Engineering, Graduate Research Fellowship, Research and Evaluation on Education in Science and Engineering, Science Technology, Engineering and Mathematics Talent Expansion Program, Course, Curriculum and Laboratory Improvement, and Advanced Technological Education.

The Directorate also receives advice from the Education and Human Resources Advisory Committee (EHRAC) on such issues as: the mission, programs, and goals that can best serve the scientific community; how EHR can promote quality graduate and undergraduate education in S&E; and priority investment areas in S&E education research. The EHRAC meets twice a year and members represent a cross section of S&E disciplines; a cross section of institutions including industry; broad geographic representation; and balanced representation of women, underrepresented minorities, and persons with disabilities.

PERFORMANCE

The FY 2009 Budget Request is aligned to reflect funding levels associated with NSF's four strategic outcome goals stated in the FY 2006-2011 Strategic Plan. These goals provide an overarching framework for progress in fundamental research and education and facilitate budget and performance integration.

Directorate for Education and Human Resources
By Strategic Outcome Goal
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate Amount	Percent
Discovery	$157.86	$164.35	$177.71	$13.36	8.1%
Learning	513.38	536.07	585.01	48.81	9.1%
Research Infrastructure	17.18	15.74	15.86	0.25	1.6%
Stewardship	7.24	9.44	11.83	2.39	25.3%
Total, EHR	$695.65	$725.60	$790.41	$64.81	8.9%

Totals may not add due to rounding.

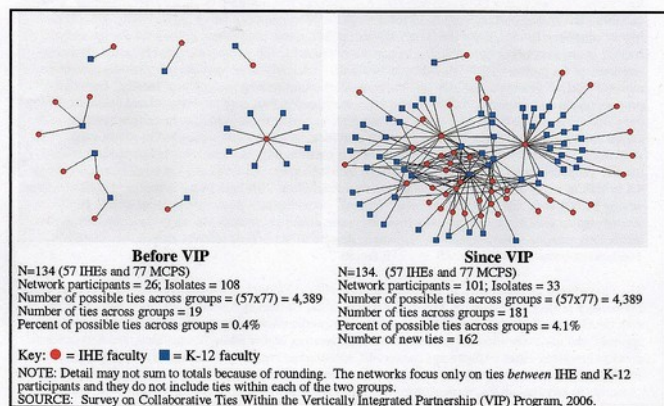### Project and Program Evaluation

In 1992, performance monitoring and evaluation of education programs in EHR became a requirement. Since that time, EHR has conducted program evaluations of over 25 STEM education programs. Beginning in 2005, EHR required that every proposed project include an evaluation plan at the time of the proposal submission.

EHR programs make up a significant portion of the STEM education inventory prepared by the Academic Competitiveness Council (ACC). EHR programs increase American competitiveness in the global economy and support NSF's underlying strategy of integration of research and education. EHR's evaluation efforts strive to assess STEM education programs for improvement and effectiveness and facilitate policy decision-making in accordance with federal reporting requirements.

Across the Foundation, STEM education programs have broad goals, and hence represent the complexity of STEM education. The complexity and different stages of development of the projects require a mix of methods, if we are to optimize our understanding of program effectiveness. Program evaluation, well established within EHR, is now being expanded Foundation-wide to cover all elements in NSF's STEM education portfolio. This is evident in efforts that range from requirements for periodic review of project activities and cross-site analyses to those that expect qualitative and quantitative evidence of a program's success.

Recent Research Highlights

Broadening Participation to Improve Workforce Development

Before VIP
N=134 (57 IHEs and 77 MCPS)
Network participants = 26; Isolates = 108
Number of possible ties across groups = (57x77) = 4,389
Number of ties across groups = 19
Percent of possible ties across groups = 0.4%

Since VIP
N=134. (57 IHEs and 77 MCPS)
Network participants = 101; Isolates = 33
Number of possible ties across groups = (57x77) = 4,389
Number of ties across groups = 181
Percent of possible ties across groups = 4.1%
Number of new ties = 162

Key: ● = IHE faculty ■ = K-12 faculty
NOTE: Detail may not sum to totals because of rounding. The networks focus only on ties *between* IHE and K-12 participants and they do not include ties within each of the two groups.
SOURCE: Survey on Collaborative Ties Within the Vertically Integrated Partnership (VIP) Program, 2006.

A network diagram, related to sharing new inquiry science teaching strategies or materials, demonstrates the increased density of vertical connections between K-12 teachers and faculty. *Credit: Vertically Integrated Partnerships K-16.*

► **Increasing Collaboration Improves Math, Science Instruction:** NSF's Math and Science Partnerships enable innovative collaboration between higher education and K-12 math and science faculty. Five years into the program, new collaborations are having a positive impact on student learning. The Vertically Integrated Partnerships project aims to foster collaboration among participating K-12 teachers in Montgomery County, Maryland public schools, and higher education faculty at the University of Maryland. An analysis of the evolving structure found an increase in such collaboration. The Partnership for Reform in Science and Mathematics (PRISM), a comprehensive project uniting state, university, and district entities, uses learning communities to improve the quality of science and mathematics teaching in Georgia. Teachers who participated in such communities reported greater emphasis on standards-based teaching than other teachers. (DUE/MSP)
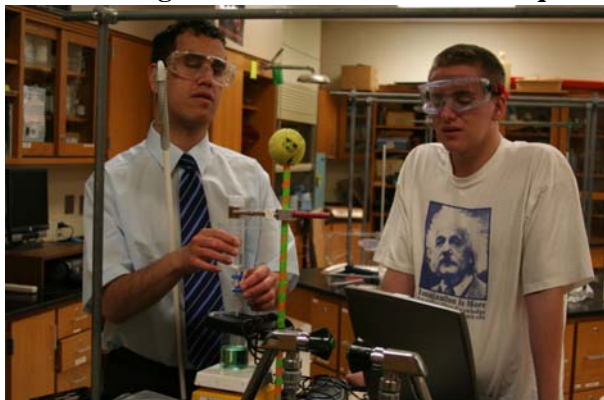
► **Building Girls' Interest in Technology**: An after-school and summer program to encourage middle school girls to pursue careers in computers and information technology (IT) has shown remarkable success in sparking interest and challenging stereotypes. "Girls Creating Games" was funded by NSF to increase the number of women and girls in IT education and the workforce. The program aims to build girls' interest, skills, confidence, and fluency in IT through activities such as computer game design, collaborative computer programming, and working with adult female mentors. Based on pre- and post-test measures, participants reported significant increases in computer capabilities and independent problem solving skills related to IT. Findings also suggest that actively involving middle school girls in computer programming and IT processes can serve to mitigate the negative impacts stereotypes might have on girls' motivations to pursue interests and careers in STEM. The data collected from this program have made contributions to the understanding of how IT fluency can be measured, how to support pair programming, how girls learn and problem-solve on the computer, and how to promote "intrepid exploration" to increase the likelihood that girls will become producers, not just users, of IT. (HRD)

A pair of animated, middle school girls that appear on the 'Girls Creating Games' website. *Credit: Jill Denner, Education, Training, and Research (ETR) Associates.*

► **Creating Effective Tools and Techniques for Visually Impaired Students in Chemistry:** The "Techniques and Tools to Enhance Blind and Visually Impaired Students Participation in High School Level and General Chemistry Laboratory Classes" project has developed devices and lab procedures that allow blind and visually impaired students to conduct general chemistry laboratory experiments without the aid of sighted assistants. With the support of NSF's Research in Disabilities Education (RDE) program the research team at Penn State's Independent Laboratory Access for the Blind project (ILAB) has produced several devices for conducting chemistry experiments including a hand-held, submersible audible light sensor that fits in a test tube and converts the light intensity to an audible signal. They also created an inexpensive portable color recognizer to detect color of a substance in a beaker. The ILAB team has also been working

Blind students independently conduct a chemistry experiment. *Credit: Reprinted with permission from C&EN Copyright 2007 American Chemical Society. Photograph by Linda Wang.*

with industry partners, including the Vernier Software and Technology Company, to make commonly used scientific software accessible to blind students who use speech output systems when independently conducting chemistry experiments. These science lab tools have been used by students at the Indiana State School for the Blind and at the Hopewell Valley Central High School, in Pennington, NJ. (HRD)

► **Graduate Research Fellow Links Basic Research with Innovative Entrepreneurship:** NSF Graduate Research Fellow Geoff Benton is linking his quest for new knowledge and his entrepreneurial interests to a career that involves technology transfer from academia to industry. In addition to his work on the basic science of mammalian cancer genes, he is working with Professor Thea Tlsty at the University of California at San Francisco. Geoff has been studying the effects of a tumor suppressing gene, p16, on the ability of cells to renew themselves. Last year, Geoff discovered new metabolic changes caused by the loss of p16 in human cells, thereby demonstrating a unique interaction between tumor suppressor genes and metabolism. Geoff and a fellow student also developed and launched JeffsBench.com, a social networking tool for the scientific community that improves communication and collaboration among graduate and post-doc researchers. (DGE)

Image from social networking online tool for the scientific community that improves communication and collaboration among graduate and post-doc researchers. *Credit: Geoff Benton.*

Enriching the Education of STEM Teachers

► **Noyce Scholars Prepared to Teach in High-Need Schools:**
The Robert Noyce Teacher Scholarship program at California
State University, Fresno has recruited 63 new math and science
teachers to teach in high-need school districts in California's
Central Valley. Noyce scholars are placed in a high-need school
science or mathematics classroom under the guidance of a
selected mentor teacher and spend six to 10 hours per week as a
teaching assistant. This experience affords Noyce Scholars a
chance to develop classroom "survival skills" early on and to
experience a wide range of activities associated with the teaching
profession well before their student teaching semester. The
program includes workshops taught by college faculty and expert
K-12 teachers. Noyce Scholars have an opportunity to participate
in cutting edge research through summer internships in
Department of Energy laboratories. They also participate in
professional development activities offered to area science and
math teachers. Sixty five percent of the CSU Fresno Noyce

Samuel Saldivar, Noyce Scholar
undergraduate from California State
University, Fresno, participates in
mathematics lesson study with math teachers
and other Noyce Scholars while serving as a
teaching assistant in Sanger Unified School
District through the CSU-Noyce early field
experience program. *Credit: David Andrews.*

Scholars are from underrepresented populations. The Scholars are continuing to teach in high need
school settings beyond the required commitment. (DUE)

Graduate Fellows Ian Saginor and Marie Montes-
Matias assist students with an activity on
pressure and its role in volcanoes in Rutgers
University's mobile laboratory. *Credit: GK-
12/Rutgers University.*

► **Science Hits the Road:** Three projects in NSF's Graduate
Teaching Fellows in K-12 Education (GK-12) program have
together reached thousands of students. Rutgers University
launched a 40-foot mobile laboratory bringing graduate students
to deliver hands-on science to 14 middle schools and
communities around New Jersey. Popular lessons focus on
volcanoes, DNA and forensics. The Florida Institute of
Technology's project highlights ocean sciences. A 35-foot
mobile laboratory for high school students in Brevard County
supports hands-on learning with multiple work stations and
equipment including microscopes, GPS systems, and a weather
station. The project at the University of Puerto Rico (Mayaguez)
brings science to K-12 students through the "Science On
Wheels" program, in which graduate fellows travel to schools
and field sites to work with teachers and students. (DGE)

*Furthering Public Understanding of Science and Advancing STEM
Literacy*

► **Public Gets Science Buzz in Real Time**: The Science Museum
of Minnesota's "Science Buzz" interactive Web site
(http://dev.smm.org/buzz/) helps address the science literacy gap by
blending up-to-the-minute science news and the latest Web technologies
with science museum interactive and interpretive exhibits. Using an RSS
feed, an open-source content management system and other
technologies, Science Buzz allows visitors not only to learn about
science, but to ask scientists questions, respond to polls on science-
related issues, and post blog entries. Science Buzz can base new content

Museum visitor sending a "post card"
with his photo and a link to the Science
Buzz web site to a friend by e-mail.
Credit: Science Museum of Minnesota.

on user feedback and enrich users' experience by linking them with news media, resources, and experts. This transformative project demonstrates new ways in which scientists can reach across formal and informal settings and convey to the public the processes whereby scientific research unfolds. (DRL)

Promoting Cyber-enabled Learning Strategies to Enhance STEM Education

Happy graduates of Scholarship for Service supported students from the master of science in security informatics program at the Johns Hopkins University. *Credit: Gerald Masson.*

► **Johns Hopkins Information Security Institute:** The Johns Hopkins University Information Security Institute will have awarded 32 master of science in security informatics (MSSI) degrees to NSF Scholarship for Service (SFS) scholarship recipients as of May 2008. Additionally, six of these students will have completed an innovative dual masters program, developed with the support of an SFS capacity building grant, which lets students complete the requirements of the degree and another master of science degree program within two academic years. Upon completion of the degree program, SFS scholarship recipients have been placed into positions at the National Security Agency, Treasury Department, National Institute of Standards and Technology, National Aeronautics and Space Administration, Internal Revenue Service, Central Intelligence Agency, Federal Reserve Board, Lawrence Livermore Labs, Hopkins Applied Physics Lab, Executive Office for U.S. Attorneys, U.S. Army, Army Space and Terrestrial Communication Directorate, and the Department of Health and Human Services. (DUE)

Other Performance Indicators

The table below shows the number of people that participate in EHR funded activities.

Number of People Involved in EHR Activities

	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Senior Researchers	5,904	5,950	6,000
Other Professionals	2,601	2,600	2,700
Postdoctorates	302	310	315
Graduate Students	6,806	6,900	7,700
Undergraduate Students	3,918	4,000	4,100
K-12 Students	10,800	12,000	12,500
K-12 Teachers	60,700	62,000	63,500
Total Number of People	91,031	93,760	96,815

In addition, it is estimated that in FY 2007 EHR programs directly impacted more than 400,000 K-12 teachers and more than 16 million K-12 students nationwide. Examples of direct impact include use of EHR-funded instructional materials by teachers and students, and students that benefit from teacher attendance at EHR-supported workshops and training seminars.

RESEARCH ON LEARNING IN FORMAL AND INFORMAL SETTINGS $226,500,000

The FY 2009 Budget Request for the Division of Research on Learning in Formal and Informal Settings (DRL) is $226.50 million, an increase of $12.50 million, or 5.8 percent, over the FY 2008 Estimate of $214.0 million.

Research on Learning in Formal and Informal Settings Funding
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate Amount	Percent
Research on Learning in Formal and Informal Settings	**$208.99**	**$214.00**	**$226.50**	**$12.50**	**5.8%**
Major Components:					
Discovery Research K-12	98.16	100.00	108.50	8.50	8.5%
Informal Science Education (ISE)	63.93	65.00	66.00	1.00	1.5%
Research and Evaluation on Education in S&E	41.89	42.00	42.00	-	-
Project and Program Evaluation	5.01	7.00	10.00	3.00	42.9%

About DRL:

The Division of Research on Learning in Formal and Informal Settings advances the coherent integration of STEM education research, development, evaluation, and synthesis activities. DRL focuses on the full spectrum of basic and applied research in STEM education in both formal and informal settings, at all levels. There is a strong emphasis on improving STEM teaching and learning in the K-12 domain through cutting-edge development and applied research.

DRL programs provide national leadership for advancing discovery and innovation at the frontiers of STEM teaching and learning in the K-12, undergraduate, and graduate settings, and in lifelong learning. The Division is committed to improving STEM learning, particularly in K-12 schools, and in informal education environments; advancing equity and participation in STEM for all; and integrating research and practice. DRL research and development addresses significant educational challenges, including preparing and supporting highly qualified teachers in the STEM disciplines with strong, integrated knowledge of the disciplines and of pedagogy. DRL sponsors the design of research-based K-12 learning tools, resources, and materials that embody high expectations for all students, and studies and evaluations of their strategic implementation and impact. Research in DRL addresses issues of STEM learning at the undergraduate and graduate levels, and across the lifespan. The Division is concerned with expanding the number of students interested in and educated for careers in STEM fields and ensuring that the citizenry has the opportunities to continue their learning of science in a variety of exciting and compelling venues.

DRL Priorities for FY 2009:

DRL has leadership within EHR for two of the five thematic priorities in FY 2009: Public Understanding and Research and Evaluation. The increased funding for evaluation aims to bring the expertise within the division to improvements in evaluation. DR-K12 is a significant contributor to Enriching the Education of STEM Teachers priority; ISE has a national leadership role in Furthering Public Understanding of Science and Advancing STEM Literacy; and DRL's Project and Program Evaluation expertise is a keystone to EHR's Promoting Learning through Research and Evaluation priority.

- **Discovery Research K-12** (DR-K12) supports applied research and innovation aimed at improving STEM education at the K-12 level. The research and evaluation in DR-K12 projects focus on K-12 instructional resources and tools developed with NSF funding, and includes development, implementation, and evaluation activities conducted in K-12 settings. Discovery research addresses problems generated by practice and implementation and is focused on targeted, strategic interventions. The program allows for continued efforts to develop and evaluate cutting-edge materials in K-12 STEM.

- **Informal Science Education** (ISE) supports the design and development of experiences that encourage learning in informal settings and that promote public engagement with, and understanding of, the STEM disciplines. ISE projects advance leading-edge, state-of-the art efforts to expand the venues and opportunities for science learning, for all learners at all ages. Projects that strengthen infrastructure, engage underserved audiences, involve the public, and introduce innovative uses of technologies will be of highest priority.

- **Project and Program Evaluation** is a strong focus of EHR/DRL. Emphases include planning and oversight for third-party evaluations of EHR programs and thematic STEM evaluation studies; providing evaluation technical assistance throughout EHR and NSF as well as providing training opportunities and tools to build capacity in the field. EHR's evaluation team coordinates data collection efforts for performance monitoring and responding to GPRA and other federal reporting requirements; disseminates broader information and evaluation findings to various stakeholders; and addresses directorate-wide knowledge management concerns for improved productivity.

- **Research and Evaluation on Education in Science and Engineering** (REESE) supports basic and applied research and evaluation that enhances understanding of STEM learning and teaching. The program seeks proposals for syntheses of research and evaluation in order to accumulate knowledge, identify gaps, and integrate across literatures and disciplines. REESE also supports empirical studies that advance discovery and innovation at the frontiers of STEM learning. The REESE program spans formal and informal education and all stages of learners.

Changes from FY 2008:

- The FY 2009 Request for **DR-K12** is $108.50 million, an increase of $8.50 million over the FY 2008 Estimate of $100.0 million. As part of the new EHR investment, *Teacher Education in STEM: Enriching Knowledge and Practice,* DR-K12 investments will broaden participation in the S&E enterprise through the development of more effective tools and resources for teachers and students, which will support inquiry-based classroom practices and a more intensive scientifically-based assessment of the efficacy of these resources. The increase in DR-K12 will address the broad recognition that teacher education in STEM is critical to the Nation's future and ensure that teachers know how to guide and assess the learning of STEM content in age-appropriate ways, using available tools and resources.

- The FY 2009 Request for **Project and Program Evaluation** is $10.0 million, an increase of $3.0 million over the FY 2008 Estimate of $7.0 million. These additional funds will be used to support thematic STEM evaluation projects designed to enhance science and engineering workforce development and for collaborations with advanced learning technologies in science and engineering using cyberinfrastructure.

- The FY 2009 Request for **ISE** is $66.0 million, an increase of $1.0 million over the FY 2008 Estimate of $65.0 million. This will result in 1-3 additional awards in FY 2009.

UNDERGRADUATE EDUCATION $219,830,000

The FY 2009 Budget Request for the Division of Undergraduate Education (DUE) is $219.83 million, an increase of $8.78 million, or 4.2 percent, over the FY 2008 Estimate of $211.05 million.

Undergraduate Education Funding
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate	
				Amount	Percent
Curriculum, Laboratory and Instructional Development[1]	$84.41	$83.45	$85.41	$1.96	2.3%
Workforce Development[1]	74.60	79.10	83.42	4.32	5.5%
Math and Science Partnership	45.95	48.50	51.00	2.50	5.2%
Total, DUE	**$204.96**	**$211.05**	**$219.83**	**$8.78**	**4.2%**
Selected Programs:					
Advanced Technological Education	50.58	51.62	51.62	-	-
Course, Curriculum, and Laboratory Improvement	37.78	37.50	39.21	1.71	4.6%
Robert Noyce Teacher Scholarship Program	10.30	10.80	11.60	0.80	7.4%
Scholarship for Service	11.36	11.50	15.00	3.50	30.4%
STEM Talent Expansion Program	28.90	29.70	29.70	-	-

Totals may not add due to rounding.

1/ The Robert Noyce Teacher Scholarship program is included in the Workforce Development line. NSF proposes to move this program from the Curriculum, Laboratory, and Instructional Development line as of FY 2008 in order to better align with the program's purpose.

About DUE:

DUE is the NSF focal point for transforming undergraduate STEM education to meet the needs of the 21st century. DUE's objective is to increase the quality and quantity of the science and engineering workforce, and the extent to which all undergraduate students are well prepared for an increasingly technological global society. DUE programs emphasize innovation and ongoing improvement in curricula, teaching procedures, and laboratories, so that the next generation is always learning by using the tools and methods of inquiry that working professionals use. Collaborations among institutions, and between higher education, industry, and the K-12 sector are encouraged. So that best practices penetrate deeply into the community, DUE grants provide for faculty development, support for new instructional materials, the reform of courses, laboratories, and curricula, and assessment of outcomes.

DUE programs are funded through three budget lines. Included in the Curriculum, Laboratory and Instructional Development line are the Course, Curriculum, and Laboratory Improvement program, the STEM Talent Expansion Program, and the National Science Distributed Learning program. Workforce Development includes Advanced Technological Education, Federal Cyber Service: Scholarship for Service, the Robert Noyce Teacher Scholarship Program, and Excellence Awards in Science & Engineering. The Math and Science Partnership program is funded through its own budget line.

DUE Priorities for FY 2009:

DUE leads EHR's efforts in teacher education and cyber-infrastructure for learning. DUE contributes significantly, too, to the broadening of participation and institutional integration. Its role in teacher

education will be enhanced through increases in the MSP and Noyce programs. DUE's contributions to the cyber world is most evident in the NSDL program – a program with clear implications for teacher education. With reference to the broadening of participation, DUE grantees do so through the ATE program (targeted to community colleges) and the EASE awards (especially those for mentoring). The Federal Cyber Service: Scholarship for Service program addresses the priority of Promoting Cyber-enabled Learning Strategies to Enhance STEM Education.

- The **Federal Cyber Service: Scholarship for Service** (SfS) program, which is relevant to the Comprehensive National Cybersecurity Initiative, builds a cadre of federal professionals with skills required to protect the Nation's critical information infrastructure. Scholarships provide full tuition, fees, and stipends in exchange for service in federal agencies after graduation.

- The **Math and Science Partnership** (MSP) at NSF is a research and development effort to build capacity and integrate the work of higher education, especially its STEM disciplinary faculty, with that of K-12 to strengthen and reform science and mathematics education. MSP will continue to coordinate its efforts with other education programs at NSF, the Department of Education, and in states.

- The **Course, Curriculum, and Laboratory Improvement** (CCLI) program funds development of new learning materials, faculty expertise, and assessment and evaluation. CCLI supports innovative educators who build the STEM workforce and keeps teachers aligned with change in capability of STEM disciplines.

- The **Robert Noyce Teacher Scholarship Program** encourages talented STEM undergraduate students and professionals to become K-12 mathematics and science teachers through scholarships and stipends. Projects help recipients obtain certification and become STEM teachers in high-need K-12 schools.

- The **National Science Distributed Learning** (NSDL) program provides resources for STEM education at all levels. NSDL funds projects that provide stewardship for the content and services needed by major communities of learners.

Changes from FY 2008:

- The FY 2009 Request for **CCLI** is $39.21 million, an increase of $1.71 million above the FY 2008 Estimate of $37.50 million. New funds will permit an increase in the success rate for this core program.

- The FY 2009 Request for **Noyce** is $11.60 million, an increase of $800,000 over FY 2008. Funding will support efforts to prepare STEM undergraduate majors and STEM professionals to become K-12 science and mathematics teachers.

- The FY 2009 Request for **NSDL** is $16.50 million, an increase of $250,000 over the FY 2008 Estimate and provides for continued stewardship.

- FY 2009 funding for **SfS** is increased by $3.50 million over the FY 2008 Estimate to $15.0 million, which will to support up to an additional nine cohorts of up to 10 students each.

- In FY 2009, funding for **EASE** is increased to $5.20 million, $20,000 above the FY 2008 Estimate.

- The FY 2009 Request for **MSP** is increased by $2.50 million over the FY 2008 Estimate to $51.0 million. Of this increase, $1.50 million supports the Innovation through Institutional Integration effort. The remaining $1.0 million support the Teacher Education thematic priority.

GRADUATE EDUCATION $190,700,000

The FY 2009 Budget Request for the Division of Graduate Education (DGE) is $190.70 million, an increase of $30.60 million, or 19.1 percent, over the FY 2008 Estimate of $160.10 million.

Graduate Education Funding
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate	
				Amount	Percent
Graduate Education	**$155.90**	**$160.10**	**$190.70**	**$30.60**	**19.1%**
Major Components:					
Integrative Graduate Education and Research Traineeships (IGERT)	25.27	25.00	25.00	-	-
Graduate Research Fellowships (GRF)	86.08	88.10	116.70	28.60	32.5%
Graduate Teaching Fellows in K-12 Education (GK-12)	44.55	47.00	49.00	2.00	4.3%

About DGE:

DGE investments support graduate students and innovative graduate programs that prepare tomorrow's leaders in science and engineering. DGE funding for science, technology, engineering, and mathematics (STEM) graduate education supports the creation of a diverse STEM workforce to meet the needs of the Nation in the 21st century. DGE accomplishes this by providing fellowships and traineeships, by supporting innovations in STEM graduate education to prepare students for the challenges of the new century, and by building stronger links between higher education and K-12 education. These efforts help strengthen U.S. education at all levels and help ensure continued U.S. economic and research preeminence.

DGE meets its objectives through three graduate education programs: IGERT, GRF, and GK-12. Approximately 5,450 graduate fellowships and traineeships will be supported NSF-wide in FY 2009.

DGE Priorities for FY 2009:

- A significant increase is proposed for the **Graduate Research Fellowship** program, which strategically invests in intellectual capital, providing support to individuals who are pursuing graduate education. It prepares the most promising science, mathematics, and engineering students in the U.S. for a broad range of disciplinary and cross-disciplinary careers. It offers three years of financial support, which may be used by students over a five-year period, providing a flexible operational framework.

  Since 1952, over 43,000 U.S. students have received GRFs. In FY 2009 approximately 3,075 fellows will be supported, primarily with DGE funds. The Directorates for Engineering (ENG) and Computer and Information Science and Engineering (CISE) also provide support for the GRF program. Although at early stages of their careers, Fellows begin building distinguished records of accomplishment. GRF is widely recognized as a unique fellowship grant program because it supports the broad array of science and engineering disciplines across all fields as well as international research activity. In FY 2007, DGE received over 8,000 applications for its highly prestigious and competitive GRF awards, and was able to award approximately 900 fellowships.

- The **Graduate Teaching Fellows in K-12 Education** program supports fellowships and associated training that enable graduate students in NSF-supported STEM disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers. Through interactions with teachers in K-12 schools, graduate students improve communication and teaching skills while enriching STEM instruction in these schools. Approximately 950 GK-12 fellows will be supported NSF-wide in FY 2009. Through collaboration with the Office of Cyberinfrastructure (OCI), GK-12 is developing opportunities for fellows to explore CI applications in research and education. Each year GK-12 receives more excellent proposals than can be funded. In the FY 2007 competition, the GK-12 program received 140 proposals, and made approximately 27 awards.

- EHR's funding for the **Integrative Graduate Education and Research Traineeship** program is level with the FY 2008 Estimate. IGERT is an NSF-wide program administered by DGE and is part of EHR's Innovation through Institutional Integration effort. IGERT prepares U.S. doctoral students to lead the Nation in advancing knowledge in emerging areas of research and to pursue successful careers in academia, industry, or the public sector. IGERT (institutional) awardees prepare doctoral students by integrating research and education in innovative ways that are tailored to the unique requirements of newly emerging interdisciplinary fields and new career options. IGERT campuses train students to be leading scientists and engineers in the 21st century, provide several trainees with international experiences, and focus on broadening participation. Approximately 1,425 IGERT trainees will be supported across NSF in FY 2009.

Each of the three major DGE programs recognizes the growing significance of the changing global environment for future scientists and is taking steps to bring more international emphasis and provide more opportunities for students to expand their knowledge of research and education in other nations and international issues affecting STEM careers.

Changes from FY 2008:

- The EHR FY 2009 Request for GRF is $116.70 million, an increase of $28.60 million over the FY 2008 Estimate. This increase will provide support for an additional 700 graduate students.

- The EHR FY 2009 request for GK-12 is $49.0 million, an increase of $2.0 million over the FY 2008 Estimate. This increase will allow NSF to fund 45 additional students.

HUMAN RESOURCE DEVELOPMENT $153,380,000

The FY 2009 Budget Request for the Division of Human Resource Development (HRD) is $153.38 million, an increase of $12.93 million, or 9.2 percent, over the FY 2008 Estimate of $140.45 million.

Human Resource Development Funding
(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate Amount	Percent
Undergraduate/Graduate Student Support	$76.36	$83.35	$86.85	$3.50	4.2%
Research and Education Infrastructure	34.11	40.35	47.28	6.93	17.2%
Opportunies for Women and Persons with Disabilities	15.33	16.75	19.25	2.50	14.9%
Total, HRD	**$125.80**	**$140.45**	**$153.38**	**$12.93**	**9.2%**

Totals may not add due to rounding.

About HRD:

HRD supports programs and activities that enhance the quantity, quality, and diversity of individuals engaged in U.S. science, technology, engineering, and mathematics (STEM). HRD plays a central role in increasing opportunities in STEM education for individuals from historically underserved populations – particularly minorities, women, and persons with disabilities – as well as the educators, researchers, and institutions dedicated to serving these populations.

HRD programs are funded through three budget lines. Included in the Undergraduate/Graduate Student Support line are the Louis Stokes Alliances for Minority Participation program, the Tribal Colleges and Universities Program, and the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP). Research and Education Infrastructure includes the Alliances for Graduate Education and the Professoriate and Centers of Research Excellence in Science and Technology programs. Included in the Opportunities for Women and Persons with Disabilities are the Research on Gender in Science and Engineering program, the Research in Disabilities Education program, and the ADVANCE program.

HRD Priorities for FY 2009:

HRD is central to EHR's thematic priority of Broadening Participation to Improve Workforce Development. The FY 2009 Request supports programs with a proven track record of broadening participation in the science and engineering workforce.

HRD is also a centerpiece in Innovation through Institutional Integration. The flagship programs in HRD that collaborate on this effort are LSAMP, AGEP, CREST, ADVANCE, the Research on Gender in Science and Engineering (GSE) program, and the Research in Disabilities Education (RDE) program. This effort will support student research experiences; adaptive learning experiences; cyber-enabled learning activities that promote integration and synergy; international experiences, and innovative curricula activities. This effort is expected to better integrate the existing activities and lead to innovative institution-wide benefits.

Significant contributions are expected from the HRD community in EHR's priority to enrich the education of STEM teachers. Through this new research and development investment, LSAMP and TCUP will work to advance knowledge and practice in the preparation of K-12 STEM teachers and to

encompass the entire continuum – from pre-service education, to induction, to continuing professional development.

Changes from FY 2008:

- **CREST** funding for FY 2009 is $30.53 million, an increase of $5.53 million. This increase will support an additional CREST award, 2 to 4 additional projects in the HBCU-RISE activity, up to 10 additional partnership supplements for the existing portfolio, and/or up to 12 additional SBIR/STTR diversity collaborations with industry partners co-funded with the Directorate for Engineering. Some combination of these award types is expected based on the most meritorious proposals received.

- **LSAMP** funding for FY 2009 is $42.50 million, an increase of $2.0 million. This increase will support up to two additional AMPs and/or up to two new sites for Bridge to Teaching awards. These programs expand the participation of underrepresented minorities in STEM fields thereby strengthening the Nation's science and engineering workforce.

- **AGEP** funding for FY 2009 is $16.75 million, an increase of $1.40 million. This increase will support activities that focus on critical junctures into the professoriate such as funding auxiliary services to the current AGEP community to promote networking at a national level and significantly increase leveraging opportunities with respect to career progression of minority doctoral recipients.

- **GSE** funding for FY 2009 is $11.50 million, an increase of $1.25 million. Additional GSE funds will support two additional "diffusion of research-based innovation projects," which aim to inform practitioner communities about new advances in education research that enable more girls and young women to pursue STEM education and careers.

- **HBCU-UP** funding for FY 2009 is $31.0 million, an increase of $1.0 million. Additional HBCU-UP funds will support 4 to 8 new HBCU/STEM teacher development projects to increase the numbers and high-quality preparation of teachers, through program tracks currently in place (Implementation, Targeted Infusion, and Education Research).

- **ADVANCE** funding for FY 2009 is $1.25 million, an increase of $750,000. Funds will be used to forge relevant institutional linkages with other broadening participation efforts and to support value-added international activities to increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse STEM workforce.

- **RDE** funding for FY 2009 is $6.50 million, an increase of $500,000. This will support an additional Focused Research Initiative award, which will use a quasi-experimental approach to investigate evidenced-based practices preparing science and math educators to effectively teach students with disabilities.

- **TCUP** funding for FY 2009 is $13.35 million, an increase of $500,000. This increase will support up to two additional implementation awards which would include either a STEM Teachers of Excellence Education Project (STEEP) or a Phase II project from an institution that has already received a TCUP award. Additionally, the program will support a pilot effort to increase the participation in, and the scope of, individual undergraduate, placed-based research projects at several TCUP colleges.

H-1B NONIMMIGRANT PETITIONER FEES $100,000,000

The FY 2009 H-1B Nonimmigrant Petitioner Fees are projected to be $100.0 million, equivalent to the FY 2008 projection.

H-1B Nonimmigrant Petitioner Fees Funding

(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	Change over FY 2008 Estimate	
				Amount	Percent
H-1B Nonimmigrant Petitioner Fees Funding	$145.90	$100.00	$100.00	-	-

Beginning in FY 1999, Title IV of the American Competitiveness and Workforce Improvement Act of 1998 (P.L. 105-277) established an H-1B Nonimmigrant Petitioner Account in the general fund of the U.S. Treasury for fees collected for each petition for alien nonimmigrant status. That law required that a prescribed percentage of funds in the account be made available to NSF for the following activities:

- **Computer Science, Engineering, and Mathematics Scholarships** (CSEMS). The program supported grants for scholarships to academically-talented, financially needy students pursuing associate, baccalaureate, or graduate degrees in computer science, computer technology, engineering, engineering technology, or mathematics. Grantee institutions awarded scholarships of up to $2,500 per year for two years to eligible students.

- **Grants for Mathematics, Engineering, or Science Enrichment Courses.** These funds provided opportunities to students for enrollment in year-round academic enrichment courses in mathematics, engineering, or science.

- **Systemic Reform Activities.** These funds supplemented the rural systemic reform efforts administered under the former Division of Educational System Reform (ESR).

In FY 2001, Public Law 106-311 increased the funds available by increasing the petitioner fees. Also, the American Competitiveness in the 21st Century Act (P.L. 106-313) amended P.L. 105-277 and changed the way petitioner fees were to be expended.

- The CSEMS activity continued under P.L. 106-313 with a prescribed percentage of H-1B receipts. The maximum scholarship duration was four years and the annual stipend was $3,125. Funds for this scholarship program totaled 59.5 percent of the total H-1B funding for NSF.

- Private-Public Partnerships in K-12. P.L. 106-313 directed the remaining 40.5 percent of receipts toward K-12 activities involving private-public partnerships in a range of areas such as materials development, student externships, and mathematics and science teacher professional development.

- Information Technology Experiences for Students and Teachers (ITEST) developed as a partnership activity in K-12 to increase opportunities for students and teachers to learn about, experience, and use information technologies within the context of STEM, including Information Technology (IT) courses.

In FY 2005, Public Law 108-447 reauthorized H-1B funding. NSF was provided with 40 percent of the total H-1B receipts collected. Thirty percent of H-1B receipts (75 percent of the receipts that NSF receives) are to be used for the Low-income Scholarship Program. Ten percent of receipts (25 percent of

the receipts that NSF receives) are designated for support of the Grants for Mathematics, Science, or Engineering Enrichment Courses.

Low-income Scholarship Program. Eligibility for the scholarships was expanded from the original fields of computer science, engineering, and mathematics to include "other technology and science programs designated by the Director." The maximum annual scholarship award amount was raised from $3,125 to $10,000. NSF may use up to 50 percent of funds "for undergraduate programs for curriculum development, professional and workforce development, and to advance technological education." Because of the changes, the program was renamed in 2006 from CSEMS to Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM).

Since its inception the low-income scholarship program has received approximately 2222 proposals from all types of colleges and universities and has made awards for 768 projects. Approximately 45,000 students have received scholarships ranging from one to four years, and many new grants have yet to award all their scholarships. In addition to scholarships, projects include student support activities featuring close involvement of faculty, student mentoring, academic support, and recognition of the students. Such activities are important in recruiting and retaining students in high-technology fields through graduation and into employment. Approximately 100 awards are anticipated in FY 2009.

ITEST Grants for Mathematics, Science, or Engineering Enrichment Courses. The ITEST program invests in K-12 activities that address the current concern about shortages of STEM professionals and information technology workers in the U.S. and seeks solutions to help ensure the breadth and depth of the STEM workforce, including education programs for students and teachers that emphasize IT-intensive careers. In FY 2008, the guidelines were revised to address the development, implementation, testing, and scale-up of models, as well as research studies to improve the STEM workforce and build students' capacity to participate in the STEM workforce, especially the information and communication technology (ICT) areas. The new ITEST solicitation extends the previous solicitation by placing greater emphasis on capturing and establishing a reliable knowledge base about the dispositions toward and knowledge about STEM workforce skills in U.S. students; the name of the program was also changed in this solicitation to Innovative Technology Experiences for Students and Teachers. New categories of awards include: (1) *Strategies projects* for the design, implementation, and evaluation of models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers to encourage students' readiness for, and their interest and participation in the STEM workforce; (2) *Scale-Up projects* that support the implementation and testing of models that prepare students for information technology or the STEM workforce in a large-scale setting such as a state or at the national level; and (3) *Studies projects* that support research to enrich the understanding of issues related to enlarging the STEM workforce, including efficacy and effectiveness studies of intervention models, longitudinal studies, instruments, and studies to identify predictors of student inclination to pursue STEM career trajectories. The Strategies, Scale-up, and Studies projects replace the previous four components: youth-based projects, comprehensive projects, traditional project renewals, and the ITEST resource center.

Since its inception, ITEST has funded 115 local projects that allow students and teachers to work closely with scientists and engineers on extended research projects, ranging from biotechnology to environmental resource management to programming and problem-solving. Projects draw on a wide mix of local resources, including universities, industry, museums, science and technology centers, and school districts in order to identify the characteristics that engage a wide range of young people in STEM, especially those not successful in traditional school settings. Through a projected $110 million federal investment, ITEST impacts an estimated 130,000 students (grades 6-12), 4,300 teachers, and 1,600 parents/caregivers.

In FY 2007, ITEST received 124 full proposals and funded 30 awards, the highest number of awards in the five years of the program's existence.

In November 2005, Public Law 109-108 was signed and directed EHR to initiate a K-8 pilot program, which NSF called Academies for Young Scientists, using funds in the FY 2006 EHR appropriation. EHR used approximately $7 million of funds from its formal K-12 programming and approximately $7 million of funds from H-1B nonimmigrant petitioner fees for this effort. This effort called for proposals to develop stimulating, intensive STEM learning experiences that engage K-8 students; develop sustainable, district-based partnership demonstration projects; and promote strategies that further develop skills in K-8 STEM teachers. This activity was a demonstration project in FY 2006; no additional funds are requested. Sixteen projects are underway using a variety of promising strategies for engaging schools, business higher education, and informal science education organizations to motivate students in STEM and encourage their future involvement in the STEM workforce. A program resource center, established in 2007, has designed monitoring systems for looking at common data across sites, helped to launch a compressed longitudinal study to examine students' participation in STEM over time, and initiated a set of evaluation case studies on how various approaches can motivate and engage students in STEM.

H-1B Financial Activities from FY 1999 - FY 2007
(Dollars in Millions)

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Receipts	**$26.61**	**$48.61**	**$88.34**	**$61.04**	**$65.34**	**$0.57**	**$83.68**	**$105.32**	**$107.36**
Obligations incurred Computer Science, Engineering, and Mathematics Scholarships	0.26	23.16	68.37	34.69	25.30	33.91	0.54	80.95	100.04
Grants for Mathematics, Engineering or Science Enrichment Courses	-	0.20	4.22	5.83	16.27	-	-	-	-
Systemic Reform Activities	-	1.70	3.70	3.97	5.00	2.50	2.72	-	-
Private-Public Partnership in K-12[1/]	-	-	2.22	12.82	-	20.87	22.69	18.45	45.90
Total Obligations	**$0.26**	**$25.06**	**$78.51**	**$57.31**	**$46.57**	**$57.28**	**$25.95**	**$99.40**	**$145.94**
Unobligated Balance end of year	$26.35	$49.89	$59.72	$63.45	$83.90	$29.10	$89.58	$98.19	$63.37

1/P.L 106-313 directs that 15 percent of the H-1B Petitioner funds go toward K-12 activities involving private-public partnerships in a range of areas such as materials development, student externships, math and science teacher professional development, etc.

Explanation of Carryover

With regard to the carryover into FY 2008, significant amounts of receipts arrived late in the fiscal year and there was not adequate time to obligate the total amounts. NSF is planning earlier deadlines for the S-STEM and ITEST programs in FY 2008 so that it can make awards from H-1B visa funds earlier in the fiscal year. A carryover from FY 2008 into FY 2009 is likely if, as has been the case in previous years, most receipts arrive late in the fiscal year.