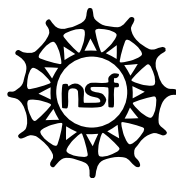


The NeXT Guide to Funding from the National Science Foundation





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Welcome to the *NeXT Guide to Funding from the National Science Foundation*.

We have compiled information about selected National Science Foundation (NSF) grant programs that have provided funding in the past for developing curricula, installing teaching and learning technology-based laboratories, and presenting faculty enhancement seminars to share successes and foster professional growth. The following represents only a small fraction of the programs sponsored by the NSF. We encourage you to contact the NSF for information about other programs that might be of interest to you, your colleagues, and your institution. (See page 3 for how to retrieve information electronically from the NSF.)

1991 was a great year for NeXT educational and research projects! The core of NeXT-based projects has grown tremendously in breadth and provides a springboard for new accomplishments this year and years to come. To show the wide range of possibilities for funding, we have included descriptions of a variety of funded projects that have made use of NeXT technology.

Please let us know how we can work together for continued successful academic pursuits.

Best regards,

A handwritten signature in black ink that reads 'O. David Spitzler'. The signature is fluid and cursive.

O. David Spitzler
Manager, Higher Education Marketing

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The National Science Foundation Programs Background and Sources



National Science Foundation: General Information

Background

The National Science Foundation (NSF) is an independent agency of the Federal Government established in 1950 to promote and advance scientific progress in the United States. The Foundation does this primarily by sponsoring scientific and engineering research and education. The NSF does not conduct research itself.

The NSF makes awards for research and education in the sciences and engineering. The awardee is wholly responsible for the conduct of such work and preparation of the results for publication.

The NSF considers proposals for support of research and education in any field of science, including but not limited to the following:

- astronomy
- atmospheric sciences
- biological and behavioral sciences
- chemistry
- computer sciences
- earth sciences
- engineering
- information science
- materials research
- mathematical sciences
- oceanography
- physics
- social science
- interdisciplinary research

In deciding which proposals to support, the NSF relies on the advice and help of advisory committees, outside reviewers, and other experts. These scientists, engineers, and educators come from colleges and universities, non-profit research and educational organizations, industry, and the Federal Government.

Most proposals come to NSF from educational institutions and other organizations rather than from individuals. However, individuals may submit proposals under special circumstances.

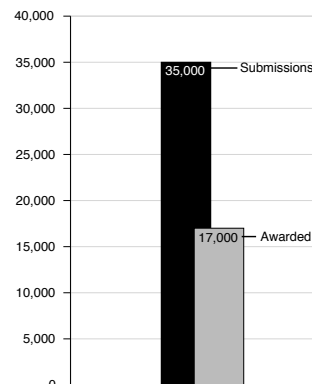
Awards may be made in response to both solicited and unsolicited proposals. Normally, those that are not solicited require cost-sharing or joint funding between NSF and the awardee(s). Awards for solicited proposals may provide for payment of all costs.

Proposal Submission

Although the actual project description is limited to 15 pages, typical proposals run 50 pages or more once all required forms and appendices are attached.

To facilitate review, five or more copies are usually required at submission unless the proposal is submitted electronically in PostScript.

Electronic proposal submission is supported at the NSF under an experimental program. Proposals may be sent to nsfprops@nsf.gov in PostScript where they are collected and previewed on NeXT computers in the Office of Information Systems.



Once a proposal is submitted, the NSF Program Officer will not discuss the status of proposal until the awards are finalized. Until an award is made, the NSF is not responsible to any charges to a pending grant.

Half of the proposals submitted to the NSF last year were funded, although not necessarily at 100% of the request.

When equipment is purchased with NSF funds, the title to the equipment is with the purchasing institution.

Vital Statistics

- Total annual budget - approximately \$2.7 billion
- Over \$2 million earmarked for computer laboratories
- Average award - \$125,000
- Approximately 17,000 proposals funded last year out of 35,000 submissions.
- Award process takes 6 to 12 months total
- 55,000+ professionals serve as reviewers
- Many faculty serve as Program Directors and rotate through the NSF on 1 to 2 year appointments
- Cost Sharing is required for most programs - usually 30 to 50% of project cost

Scientific and Technical Information Service (STIS): Getting Information Electronically from the National Science Foundation

Scientific and Technical Information Service

STIS files are available via NSF's automated document retrieval system.

To retrieve any of these files, send a mail message to the following address:

stisserv@nsf.gov (Internet)
stisserv@nsf (BITNET)

The Subject: field of your message is ignored.

The text (body) of your message must contain requests in a special format. The format is shown below:

Request: stis
Topic: <stis_topic>

Replace "<stis_topic>" with one of the "topics" in the list of available documents.

Except for "<stis_topic>" your request should look just like this example. Capitalization and white space are ignored by STIS.

To retrieve more detailed information on using STIS send the following request:

Request: info
Topic: help

For a complete index of available documents send the following request:

Request: stis
Topic: index

Notes

1. STIS files are available through other methods. For a copy of the STIS flyer, request "nsf9110" as in the following example:

Request: info
Topic: nsf9110

2. The User's Guide for STIS is document "nsf9119". For information on having STIS files mailed to you as they are added to STIS, request "stisdirm".

3. If you would like a weekly summary of the new documents on STIS, sign up for the "grants" bulletin board. Send an e-mail message to grants@nsf.gov (Internet) or grants@nsf (BITNET).

4. The NSF loads and deletes documents every week on STIS.

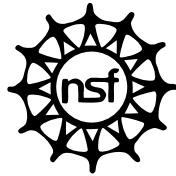
5. If you get the message "unknown topic" in your reply from stisserv, the document is probably no longer available.

6. Please note the file size shown in the list below before you request a file. Your mail system may not be able to handle large files. You can request that the file be broken into smaller pieces by using the "byte-limit" command. For example:

Request: stis
Byte-limit: 100000
Topic: nsf9119.ps

You may also enter 100000 as "100K".

Selected Funding Programs of The National Science Foundation Programs



The following programs are summarized first by program title and number, a person to contact, and a brief description of the program. More extensive information on each program follows the summaries.

Please note that the following programs are for the current funding year, and there is no guarantee that the NSF will continue any or all of these programs in the upcoming funding year. Funded programs are announced by the NSF in the fall of each year.

Because of the popularity and success of the following programs, however, NeXT believes they will be funded again for the 1993 funding year.

Please contact the NSF for more information.

Summary of Selected NSF Programs

Project Number	Title	Contact	Description
NSF 9113	Scientific Computing Research Environment for the Mathematical Sciences	SCREMS Program Director Office of Special Projects Division of Mathematical Sciences (202) 357-3453 Internet: screms@nsf.gov	Purchase of, and limited personnel support for, special-purpose computing environments dedicated to research in the mathematical sciences. These grants are intended for researchers of high quality and productivity whose research has been impaired due to lack of access to suitable equipment. Awards are made to provide support for specific research projects rather than to provide general computing capacity. Proposers are encouraged to include projects involving symbolic and algebraic computations and graphical representations (visualization) in aid of the research as well as those emphasizing traditional numerical computations and simulations.
NSF 9150	Undergraduate Course and Curriculum Development	Undergraduate Science, Engineering and Mathematics Education Division (202) 357-7051 Internet: undergrad@nsf.gov Bitnet: undergrad@nsf	Development of undergraduate courses and curricula that link meaningfully the study of science and the humanities
NSF 9152	Instrumentation Grants for Research in Computer and Information Science and Engineering	CISE Instrumentation Program Office of Cross-Disciplinary Activities (202) 357-7349 Internet: ciseinst@nsl.te.nsf.gov Bitnet: ciseinst@nsf	The equipment should be necessary for the pursuit of specific research projects, rather than provide general computing capacity. Requests for networks of personal computers and workstation clusters with servers are eligible if they are required for the research. Character of equipment: Required by more than one research project or difficult to justify for one project alone; total cost of equipment at least \$20,000. In particular, requests should not be for equipment that could be expected to be provided on research grants made by disciplinary programs.
NSF 9154	Facilitation Awards For Scientists and Engineers With Disabilities	Coordinator, Facilitation Awards for Scientists and Engineers with Disabilities (202) 357-7461 (202) 357-7492 Inquiries relating to scientific work should be directed to the cognizant NSF program officer.	Requests for special equipment or assistance may be included in the original proposal submitted to a Foundation program or submitted as a separate request for supplemental funding for an existing grant. There is no separate program for special equipment or assistance. Requests are made in conjunction with regular competitive proposals, and funds are provided as part of any resulting grant or as a supplement to an existing NSF award.

Project Number	Title	Contact	Description
NSF 9184	Instrumentation and Laboratory Improvement Program	ILI Program Director (202) 357-7051	Supports acquisition of instruments for laboratory courses in science, mathematics, or engineering. Provides matching grants in the range of \$5,000 to \$100,000 for instrumentation that serves as the basis for undergraduate instructional improvement.
NSF 91125	Undergraduate Curriculum Development in Mathematics Calculus and the Bridge to Calculus	Division of Undergraduate Science, Engineering, and Mathematics Education (202) 357-7051 Internet: undergrad@not.nsf.gov Bitnet: undergrad@nsf	The Undergraduate Curriculum Development program provides support for the development, adaptation, refinement, and implementation of prototypical instructional materials and model curricula and generally does not provide for equipping laboratories. Normally, the acquisition of necessary equipment is the responsibility of the institution. However, the Foundation can provide support for the development and implementation of advanced technology applications. In addition, in some special cases support can be provided for curriculum development projects for a modest amount of equipment if that equipment is necessary for completion of the proposed project.
NSF 91140	Academic Research Infrastructure Program	Office of Science and Technology Infrastructure Academic Research Infrastructure (202) 357-9808 Internet: ari@nsf.gov Bitnet: ari@nsf	The Program will assist in the acquisition or development and maintenance and technical support of major research instrumentation that is not usually available through other NSF programs. Awards for instrumentation will range from \$100,000 to \$2 million—50% of the total cost (\$200,000 to \$4 million) of instrumentation. The Program will provide support for instrumentation used in research and research training in those fields of science and engineering normally supported by NSF.
NSF 91131	Undergraduate Faculty Enhancement Program	Division of Undergraduate Science, Engineering, and Mathematics Education (202) 357-7051 Internet: undergrad@not.nsf.gov Bitnet: undergrad@nsf	Grants to conduct regional or national seminars, short courses, workshops, or similar activities for groups of faculty members. Grants are made for the development and implementation of activities that assist large numbers of faculty to learn new ideas and techniques in their fields, and to use the knowledge and experience gained to improve their instructional capabilities.

Scientific Computing Research Environment for the Mathematical Sciences

Description

The Division of Mathematical Sciences (DMS) of the National Science Foundation plans a limited number of grants for the purchase and support of computing equipment for research in the mathematical sciences. This solicitation briefly describes the type of proposals that will be considered eligible.

Who May Submit

U.S. educational institutions with ongoing research programs in mathematics, applied mathematics, or statistics. Proposals involving inter-institutional or inter-departmental sharing arrangements are welcome.

Purpose

Purchase of, and limited personnel support for, special-purpose computing environments dedicated to research in the mathematical sciences. These grants are intended for researchers of high quality and productivity whose research has been impaired due to lack of access to suitable equipment. Awards are made to provide support for specific research projects rather than to provide general computing capacity. Proposers are encouraged to include projects involving symbolic and algebraic computations and graphical representations (visualization) in aid of the research as well as those emphasizing traditional numerical computations and simulations.

Character of Requests

This Program is intended to provide for needs that cannot be met by other research programs of NSF's Division of Mathematical Sciences. Thus, requests will be expected to be for support required jointly by several (two to five) research projects and/or difficult to justify for one project alone. Amalgamation of small requests that could be made to disciplinary research programs is discouraged.

Significant discounts or contributions of equipment may be available from some manufacturers. Principal Investigators are urged to explore this avenue of cost reduction, and any available discounts should be subtracted from the total budget request.

The proposal should describe the institution's provisions for space, installation, maintenance and operation of the requested equipment. NSF will not provide funds for these items, except as indicated below.

Institutions submitting proposals will be expected to bear a significant fraction of the cost of the proposed equipment, usually at least one-third of the net (after discount) cost. The level of institutional participation, which should be clearly stated in the proposal, will be a major consideration in reaching final decisions. Historically, institutional participation has generally ranged from 30% to 65% of discounted prices, with an average of about 50%. The institutional participation should not be expressed in terms of existing or irrelevant equipment, site preparation, maintenance, or installation costs.

Since FY 1990, SCREMS has broadened the scope of its activities to include, where justified and cost-effective, partial support (salary and fringe benefits) for systems administrators or programmer personnel for research computing needs. In each request for such, provision must be made by the University for substantial cost-sharing (at least half), in addition to agreeing to assume the cost permanently after a fixed, brief period, generally not to exceed two years.

No indirect costs will be permitted on equipment portions of grants. It is expected that the indirect cost rate applied to personnel will be limited to not more than 10%, with the difference between the actual indirect cost rate and 10% allocated to the substantial cost-sharing required on SCREMS awards.

Undergraduate Course And Curriculum Development Program

Purpose

There is a need to revitalize the content, conduct, and quality of undergraduate education in the sciences, engineering, and mathematics, enhance interest in these disciplines among students entering our colleges and universities, increase the participation of underrepresented groups, and encourage the most capable students to prepare themselves for teaching at the college and pre-college level.

These challenges require new and innovative approaches to all aspects of the undergraduate learning experience, but especially to introductory level curricula, courses, and laboratories. These courses are crucial in promoting the interest and enthusiasm of students with career aspirations in the sciences, mathematics, and engineering, including teaching, as well as educating students with non-scientific career objectives.

Proposals are therefore invited for introductory-level courses, curricula, and laboratories that aim to provide a sound foundation for all undergraduates to be responsible, scientifically literate citizens, prepared for careers in the sciences, engineering, and mathematics, and for subsequent learning in general. Of special concern are the large enrollment courses, which frequently involve the participation of teaching assistants.

Scope of the Program

The emphasis of the program is on introductory-level courses, curricula, and laboratories — those that enroll primarily first- and second-year college students.

The program will seek to support creative, innovative approaches and projects. Of particular interest are projects designed to produce major changes and significant improvement in undergraduate science, mathematics, and engineering education beyond the recipient institution.

Proposals may focus on an individual course or on the development of a comprehensive curriculum. Proposals targeting individual courses or laboratories might explore, for example, the effectiveness of new field ex-

periences and laboratory exercises that actively engage students and are designed to promote critical thinking, problem solving skills, and creativity; the utility of new instructional materials, information technologies and delivery systems; the value of providing more opportunities for students to communicate orally and in writing; and the impact of collaborative learning, student teaching, learning communities, and other innovations that aim to improve pedagogy in courses with large and small enrollments; the role of graduate and/or advanced undergraduate students as teaching assistants.

Proposals concerned with developing a comprehensive curriculum for first- and second-year students should include components that address the spectrum of students' interests (see Target Audience below).

Target Audience

The target audience is undergraduates enrolled in introductory-level courses. This includes:

- science, mathematics or engineering majors—to improve the education for undergraduates majoring in NSF-supported disciplines, as well as students majoring in other technical fields,
- future teachers—to improve the education of undergraduates preparing for careers in teaching science and mathematics at the pre-college or college level,
- non-science majors—to improve the scientific and technical literacy of undergraduates with major interest in fields other than science, mathematics, and engineering.

Project Size

The funds available to support new proposals for this program in FY 91 were \$9.5 million. The number and size of awards for FY 92 will depend on the quality of the proposals received and the availability of funds for this program. Projects may request support for up to five years.

Instrumentation Grants for Research in Computer and Information Science and Engineering

Description

The Computer and Information Science and Engineering (CISE) Directorate of the National Science Foundation plans a limited number of grants for the purchase of special-purpose equipment, instrumentation, or software for research in areas of science or engineering supported in the CISE Directorate.

Who May Submit

Both U.S. graduate-degree-granting institutions and U.S. four-year institutions with departments or research programs in areas of science or engineering supported in the CISE Directorate. Proposals involving inter-departmental and inter-institutional sharing arrangements are welcome.

The Foundation welcomes proposals on behalf of all qualified scientists and engineers, and strongly encourages women, minorities, and persons with disabilities to compete fully in its research and research-related Programs.

Purpose

The equipment should be necessary for the pursuit of specific research projects, rather than provide general computing capacity. Requests for networks of personal computers and workstation clusters with servers are eligible if they are required for the research (e.g., network protocol research or distributed computation research) but not if they are to be used as general purpose computing equipment.

Character of Equipment

Required by more than one research project or difficult to justify for one project alone; total cost of equipment at least \$20,000. In particular, requests should not be for equipment that could be expected to be provided on research grants made by disciplinary programs.

Principal Investigator

Department head or other person administratively responsible for the procurement, use, and maintenance of the equipment.

Proposal Preparation and Format

Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines provided in the NSF brochure, Grants for Research and Education in Science and Engineering (GRESE), NSF 90-77, August 1990. Single copies of this brochure are available at no cost from the Forms and Publications Unit, (202) 357-7668, or via e-mail (Bitnet:pubs@nsf or Internet:pubs@note.nsf.gov).

Selection Criteria

The section describing research projects and the dependence of the research on the equipment requested is the most important part of the proposal. In particular, the criteria used to evaluate the proposals will include the following specific items, not necessarily in order of importance:

- Quality of the research for which the equipment will be used, Significance of the research, Qualifications, competence and productivity of the researchers,
- Justification of need for proposed equipment in order to conduct the research,
- Choice of equipment, plan for maintenance and operation (essential support facilities),
- Effect of the research on the infrastructure of science and engineering, and institutional cost-sharing and related support.

Facilitation Awards For Scientists and Engineers with Disabilities

Objectives

The Foundation's mandate to ensure the vitality of the Nation's scientific enterprise included responsibility for the quality, distribution, and effectiveness of the human resource base in science and engineering. As part of its effort to promote full utilization of highly qualified scientists and engineers and to develop scientific and technical talent, the Foundation has the following goals:

- to reduce or remove barriers to participation in research and training by physically disabled individuals by providing special equipment and assistance under awards made by NSF, and
- to encourage disabled individuals to pursue careers in science and engineering by stimulating the development and demonstration of special equipment that facilitates their work performance.

Who is Supported

Individuals with disabilities eligible for this support include principal investigators, other senior personnel, post doctoral associates, other professionals, and graduate and undergraduate students.

What is Supported

Funds may be requested to purchase special equipment, modify equipment or provide services required specifically for the work to be undertaken. Equipment or assistance which compensate in a general way for the disabling condition are not allowed.

For example, funds may be requested to provide prosthetic devices to manipulate a particular apparatus; equipment to convert sound to visual signals, or vice versa, for a particular experiment; access to a special site or to a mode of transportation (except as defined below); a reader or interpreter with special technical competence related to the project; or other special-purpose equipment or assistance needed to conduct a particular project.

Requests in Initial Proposal Submission

In preparing proposals for submission to Foundation programs, requests for funds for special equipment or assistance to facilitate the participation of individuals with disabilities should be included in the proposed budget for the project. The budget justification should describe the specific nature, purpose and need for such equipment or assistance in sufficient detail to permit evaluation of the request by knowledgeable reviewers.

Requests for Supplemental Funding for Existing Grants

Supplemental funds for special equipment or assistance to facilitate participation in NSF-supported projects by persons with disabilities may be provided under existing NSF grants. Requests should be submitted to NSF by the principal investigator, and should include:

- standard NSF cover page countersigned by the institution's authorized organizational representative. The current grant title and number must be referenced.
- budget on NSF Form 1030 and budget justification. The specific nature, purpose and need for equipment or assistance should be described in sufficient detail to permit evaluation by knowledgeable reviewers.

Supplemental requests should be submitted directly to the cognizant NSF program. Requests will be evaluated by the responsible NSF program officer, and others as appropriate. Decisions on support will be made on the basis of the budget justification and availability of programs funds

Supplemental funding will be provided through a formal amendment of the existing NSF grant. Two to three months should be allowed for processing.

Instrumentation and Laboratory Improvement Program

Purpose and Scope

The specific objectives of ILI are to encourage and support the:

- use of modern instruments to improve the education of undergraduate students, both majors and non-majors, in science, mathematics, and/or engineering.
- introduction of new instrumental technology into science, mathematics, and engineering instruction.
- development of new experiments or applications for instruments that extend the instructional capabilities of the equipment.
- establishment of equipment-sharing via consortia or centers.

The ILI program aims to improve laboratory instruction nationally as well as at specific project sites. Accordingly, it seeks projects that will produce models for the use of instructional instrumentation. Innovative methods for using laboratory activities to improve student understanding of basic principles are especially sought.

Projects should implement a plan that goes beyond the basic level of support that the institution itself must provide in order to maintain a viable program of instruction.

Although the awards just described are expected to encompass most of the activities supported through ILI, additional ideas and mechanisms will be considered by NSF.

Eligible Fields

The Foundation will consider proposals for support of projects in:

- any field of science, mathematics and engineering ordinarily supported by the National Science Foundation, including the mathematical, physical, earth, and biological sciences, the social sciences, computer science, and engineering.
- interdisciplinary fields composed of overlapping areas of two or more eligible sciences.

- multiple disciplines—as distinct from interdisciplinary fields. Multidisciplinary proposals should be submitted only in instances where several departments propose to make joint use of a single major piece of equipment, or an assemblage of closely related pieces of equipment.

Eligible Activities

ILI proposals are encouraged for the creative improvement of laboratories or investigational activities associated with undergraduate instruction in science, mathematics, or engineering. Examples of activities eligible for equipment-based improvement include:

- introductory laboratories;
- courses that acquaint non-science majors with the principles and methods of science, mathematics, or engineering;
- laboratories for majors;
- laboratories that concern fundamental scientific, mathematical, or engineering concepts within technical, professional, or pre-professional programs;
- upgrading or replacing obsolete or unreliable equipment to expose students to concepts and/or techniques that were not possible previously;
- undergraduate honors programs, student research, and independent study.

Projects involving women, minorities, and/or persons with disabilities as staff or as students are especially encouraged, particularly if they represent models for increasing the numbers of young people in these groups who choose careers in mathematics, science, and engineering.

Eligible Project Size

ILI seeks proposals that request funds only for instructional scientific equipment. A maximum of \$100,000 may be requested from NSF; grantee institutions must provide an equal or greater matching contribution.

The minimum grant request to ILI is \$5,000 (for a total project cost of \$10,000) in NSF funds.

Undergraduate Curriculum Development in Math Calculus and the Bridge to Calculus

This program in Curriculum Development in Mathematics is an integral part of NSF's overall plan to strengthen science, engineering, and mathematics education throughout the United States.

The emphasis of the program has been shifted from the development of pilot projects involving a limited number of calculus students at the undergraduate level to the revitalization of calculus instruction on a large scale, involving students at both the collegiate and secondary levels.

The program seeks creative and innovative ways to adapt previously developed models so that they can be effective in different educational settings; the program, however, continues to seek design and development of totally new approaches. Assessment, evaluation, and dissemination activities should form important components of all projects.

The program has also been broadened to include preparation for calculus and the interface between the senior year in high school and the freshmen year in college. It is anticipated that initially the primary activity addressing issues involving calculus preparation will be conferences and workshops.

Large-Scale Curriculum Revision Projects

Projects funded under this category may be regional or local in nature and will adapt, refine, and implement approaches that may have already been developed and tested, at least on a small scale. These projects will involve at each participating institution a substantial proportion of the calculus students and of the instructors who normally teach calculus.

Per academic disciplines. Assessment and evaluation of student learning, faculty development, and institutional commitment will be an important component of all projects. Proposals should include an assessment and evaluation plan that addresses these and other aspects of the project. If appropriate, projects funded will receive assistance in providing additional data and information to NSF that is required as part of a national

longitudinal study of the impact of the curriculum revision projects. Examples of models are given in the following paragraphs.

New Development Projects

The program will continue to support particularly promising new initiatives, including major comprehensive curriculum development projects and highly focused entrepreneurial efforts. The following areas are of particular interest:

- Development of innovative materials for use in both undergraduate and AP Calculus courses
- Second year calculus, including linear algebra and differential equations

Conferences and Workshops

It is anticipated that support for a limited number of conferences and workshops to consider appropriate preparation for calculus will be provided. These workshops could bring together individuals who have been leaders in efforts to reform the secondary curriculum, individuals with experience in teaching courses at the collegiate or secondary level which have prepared students for the traditional calculus course and for revised calculus courses, and individuals who have been active in developing calculus courses at the secondary or collegiate levels.

Equipment

The Undergraduate Curriculum Development program provides support for the development, adaptation, refinement, and implementation of prototypical instructional materials and model curricula. Normally, the acquisition of necessary equipment is the responsibility of the institution. However, the Foundation can provide support for the development and implementation of advanced technology applications.

Undergraduate Faculty Enhancement Program

Purpose and Scope

The Undergraduate Faculty Enhancement Program activity makes grants to conduct regional or national seminars, short courses, workshops, or similar activities for groups of faculty members.

Grants will be made for the development and implementation of activities that assist large numbers of faculty to learn new ideas and techniques in their fields, and to use the knowledge and experience gained to improve their instructional capabilities.

The program aims to meet certain needs of faculty who teach undergraduate students. These faculty need to be familiar with recent advances in their fields, with new experimental techniques, and with ways of incorporating them into undergraduate instruction. Faculty also need experience with new instrumentation and the opportunity to evaluate its suitability for instructional use.

Projects must be regional or national in scope. They typically include seminars, short courses, workshops, and conferences, or a series of such activities, and also a set of follow-up activities. Sessions may vary considerably in length, normally from a few days to a few weeks. The follow-up activities normally span at least one academic year.

Projects should typically include specific plans to:

- permit participants to work with academic or industrial experts;
- allow participants to gain experience with recent developments in the field by working with new ideas and techniques, rather than just hearing about them;
- encourage participants to develop instructional materials that incorporate new ideas and techniques;
- enable participants to share ideas and experiences concerning how to communicate with and engage students in the topics of the project;
- enable participants to share newly gained knowledge and techniques with other faculty;

Although the kinds of projects and activities described here are expected to include the majority of those supported through the Undergraduate Faculty Enhancement Program, proposals entailing other mechanisms for enhancing the vitality of undergraduate faculty will be considered by NSF.

Eligible Activities

The aim of the program is to improve the scientific capabilities of experienced faculty members in ways that will enhance their ability to teach up-to-date undergraduate courses and laboratories.

The proposed project must emphasize active involvement of participants. Of particular interest are workshop experiences that encourage interaction of participants with invited experts, involve cooperation among participants, reflect the way practitioners in the field conduct their work, and, in general, provide examples for faculty to emulate in their own teaching.

A wide variety of audiences for different projects is appropriate. For example, programs could be designed for:

- faculty who teach introductory courses in a particular field, but who did not receive advanced degrees in that area;
- faculty who teach advanced undergraduate courses in a particular area, who have received degrees in that area, who perhaps conduct research programs in that area, but who could profit from learning new developments and techniques;
- faculty who teach an undergraduate course in a particular area and could profit from learning of new developments in another area that could be incorporated into the course;
- faculty from a group of institutions with related goals who come together for the purpose of developing faculty enhancement activities.

Follow-up Activities

All proposals must describe follow-up activities that form an integral part of the overall project.

Continued

Participants and/or their institutions should agree to participate in the follow-up activities as a part of the process of applying to attend the workshop or short course. Examples of possible follow-up activities are:

- participants would agree to incorporate a module in a course that they teach based upon the topics covered in the short course; participant reports on these experiences could be made available to all other participants; or
- groups of participants, perhaps communicating by e-mail, would develop materials for a laboratory course that would be developed, tested, and shared with all participants; or
- participants would make presentations based upon the workshop activities at local or regional meetings.

These examples are listed only as possibilities; follow-up activities should be designed to further the goals of each short course or workshop.

Two and Four Year College Coalitions

In 1992, a major thrust of the program is in support of local or regional coalitions of two- and four-year institutions. Faculty from different institutions will work together on the development of educational activities that will have impact in the classroom in a disciplinary or interdisciplinary area.

An example of a possible coalition model:

- A group of institutions might focus on an important new scientific, technological, or mathematical development or application and plan workshops involving one or more experts in that field.

Activities should include a needs assessment, a strong discipline component to the activities, an indicated high level of support from both two- and four-year institutions, and a plan for continued interactions between coalition members.

Evaluation & Dissemination Activities

To promote the efficient use of the Foundation's resources, proposals must include plans to facilitate and assess project effectiveness. These plans would include evaluation of both the conduct and accomplishments of the project. Activities should also be planned to ensure dissemination of the project outcomes.

Eligible Organizations and Fields

The program will accept proposals from scientists, engineers, and mathematicians representing appropriate organizations, including colleges and universities, national laboratories, professional societies, other non-profit organizations, for-profit industries with the scientific expertise and facilities, and other organizations that can conduct the described activities.

The project should have one director, who is responsible for its overall operation. Conduct of the project has two major components: scientific substance and administration. Often the director will be an authority in the scientific topic and will oversee both aspects of the project. In other cases, it may be appropriate for one individual to oversee the scientific component and another the administration. In such cases, either individual may be designated as the project director. Other senior personnel may also be involved if appropriate. In all cases it is desirable that there be substantial interaction between project personnel and participants.

Proposals may be submitted for support in the fields of science, engineering, and mathematics ordinarily supported by the Foundation, including the physical and biological sciences, social sciences, mathematics, computer and information sciences, and engineering, or for interdisciplinary projects that deal primarily with these fields.

Support Available & Cost Sharing

The Foundation will provide support for reasonable direct costs of operating the project, including salaries of senior personnel, clerical support, supplies, the cost of publications, postage and telephone charges, and computer services. The grantee institution is expected to provide facilities and equipment necessary to operate the project.

It is expected that the home institution will bear travel costs; lodging, meals, and other participant costs may be requested from the program. No tuition or other fees may be charged to the participants. In limited cases, funds may be provided for a stipend of up to \$50 per day of the project for participants.

In 1991, the NSF was able to fund the great majority of projects at a level between \$180 and \$280 per participant workshop day. This total NSF contribution was for all costs including the workshops, follow-up activities, participant support, and indirect costs.

Academic Research Infrastructure Program

The Academic Research Infrastructure Program is designed to improve the condition of research equipment and facilities in our Nation's academic institutions through competitive grants for:

- Acquisition or development of major research instrumentation, and/or
- Repair, renovation, or in exceptional cases, replacement of obsolete science and engineering research facilities.

Proposals submitted under this program solicitation competed for \$33 million in FY 1992 with a proposal success rate of approximately 20%.

Goals

The goals of the Academic Research Infrastructure Program are to:

- Support the acquisition, through purchase or development, of major state-of-the-art research instrumentation;
- Improve accessibility to and greater utilization of modern research instrumentation by scientists, engineers, and graduate and undergraduate students;
- Promote the modernization of science and engineering research laboratories and related facilities at institutions of higher education (including graduate and undergraduate institutions), independent nonprofit research institutions, research museums, and consortia thereof; and
- Assist graduate and undergraduate academic institutions, including those that historically have received limited Federal research and development funds, to improve their academic science and engineering infrastructure.

Scope

The purpose of this program is to improve the Nation's research infrastructure through focussed investment in the acquisition or development of major research instrumentation and revitalization of facilities used for research and research training.

The Program will assist in the acquisition or development and maintenance and technical support of major research instrumentation that is not usually available through other NSF programs. Awards for instrumentation will range from \$100,000 to \$2 million--50% of the total cost (\$200,000 to \$4 million) of instrumentation.

The Program will provide support for instrumentation used in research and research training in those fields of science and engineering normally supported by NSF.

The Program also encompasses repair or renovation, or, in exceptional cases, replacement of scientific or engineering research and research training facilities. Awards for facilities modernization will range from \$100,000 to \$2 million--50% of the total cost (\$200,000 to \$4 million).

It is not the intent of the program to fund construction or renovation of: (1) new facilities or the expansion of existing facilities; (2) facilities not devoted to scientific or engineering research; (3) facilities, such as research vessels, airplanes, and supercomputer centers.

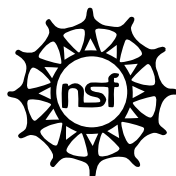
Eligible Institutions

Proposals may be submitted by institutions of higher education, independent nonprofit research institutions, research museums, and legally incorporated consortia thereof. A consortia may submit a proposal, through a university, for instrumentation to be used at a FFRDC (Federally Funded Research and Development Center).

Eligible Fields

Proposals will be considered for research infrastructure (instrumentation and/or facilities) used for any field of science, mathematics and engineering ordinarily supported by NSF.

Funded NeXT Academic Projects



The following projects were funded by the National Science Foundation in either or both of the last two funding years. For more information about a particular project, please feel free to contact the project manager directly.

Revitalizing the Engineering, Mathematics, and Science Curricula via Symbolic Algebra

An NSF Workshop for Faculty with Symbolic Algebra Experience

When

Monday, July 6 through Friday, July 10, 1992
(Also to be offered in 1993 and 1994.)

Where

Rose-Hulman Institute of Technology
5500 Wabash Avenue
Terre Haute, IN 47803

Staff

Dr. Mark A. Yoder, Electrical Engineering,
(812) 877-8291

Dr. Robert Lopez, Dept. of Mathematics,
(812) 877-8396

Course Description

This is a five-day workshop for faculty with previous exposure to computer algebra systems such as Maple or Mathematica. Faculty, drawn from engineering, science, and mathematics, will learn how to use computer algebra as an effective tool in teaching, revising curricula, and making the contents of their courses more conceptual. A participant will craft at least one instructional unit showcasing the utility of symbolic manipulation software.

Participants will be shown examples of similar curricular improvements that have already been made at Rose-Hulman. In the interdisciplinary atmosphere of the workshop, participants will conceive, create, and critique units of their own. They will leave the workshop with a clear understanding of the potential for computer algebra to transform their own curricula.

The course is taught in a laboratory equipped with NeXT workstations and Mathematica and Maple; participants are seated in front of their own workstation.

Preferred Background

Fill-time or part-time engineering, mathematics, and science faculty members with previous symbolic algebra experience.

Enrollment is limited to 30 participants who will be selected on the basis of topics they teach and their level of facility with a computer algebra system.

Cost

Registration and room and board will be covered by the NSF. The only participant cost is transportation to and from the workshop.

Contact

The course is part of the NSF Undergraduate Faculty Enhancement (UFE) Program. If you would like to attend, please contact Mark Yoder for more information.

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Selected NeXT NSF Funded Academic Projects

Engineering Design University of Houston

Through National Science Foundation grant ENG-8851973, John Glover, professor of electrical engineering and director of engineering computing at the University of Houston, is developing a prototype of the “ideal” laboratory environment for computer engineering courses. As part of the project, entitled “A Workstation Environment in a Computer Engineering Laboratory,” Glover established a lab of 14 NeXT workstations.

To help students learn object-oriented programming and the NeXTSTEP development environment, Glover created a series of course notes on object-oriented programming, which include slides that are shown by a NeXT computer using a video projector.

Glover has also implemented “Computer Engineering Design,” a senior project design course that includes instruction in project planning, management, and implementation. As part of the course requirement, students create either a hardware or software project. Those who choose to design software learn object-oriented programming and then develop courseware for the electrical engineering curriculum.

Student-developed software includes *PowerPlus!*, a three-phase power system simulator that allows the user to test various wye and delta configurations; *Meter*, a demonstration of an analog meter-type screen object; and *Beam*, an application designed by a civil engineer taking the design course that draws shear- and bending-moment diagrams for a loaded beam with three supports.

Graduate students have also written several applications, including *Adapt*, a program for teaching and research in adaptive signal processing. *Adapt* lets the user choose various signal inputs and then shows all relevant filter parameters and signals during the adaptation.

Glover’s course notes, UHOOPclass.tar.Z, are available via anonymous FTP from nova.cc.purdue.edu in /pub/next/docs. The notes will be updated in summer 1992 for NeXTSTEP Release 3.0.

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Mathematics Ohio State University

Calculus&Mathematica, originated by Horatio Porta and Jerry Uhl at the University of Illinois has been supported in both development and usage by grants from the National Science Foundation.

Currently, calculus instructors at more than 20 institutions use *Calculus&Mathematica*. Half the schools use the courseware on with NeXT computers—including Ohio State, which has a 40-unit NeXTstation lab, specifically for use with *Mathematica*.

Calculus&Mathematica is presented through 60 *Mathematica* Notebooks that students complete at a rate of about two per week. Each Notebook is divided into three sections—*Basics*, *Tutorials* and *Give It a Try*. *Basics* and *Tutorials* provide completed exercises that illustrate the principles students will learn about in *Give It a Try*. According to William Davis of Ohio State, the *Give It a Try* problems, which allow students to discover and then apply the basic principles of calculus, are the “centerpiece” of the course.

The *Give It a Try* section provides the experiences introducing ideas and topics, the challenges to intellect and patience, the excitement of beating the course and solving a very difficult problem. There is no rote manipulation in this class. Problems are open-ended. Students no longer simply memorize a formula and then plug it in to solve a particular equation. They play, conjecture, test, conjecture, play more, and almost always come to the correct conclusion.

Davis teaches *Calculus&Mathematica* completely as a lab course—there are no lectures though the instructor typically devotes ample time for answering students’ questions. Students are assigned lessons and exercises and spend class time and one to two hours after each class working on a Notebook. During the class session, Davis walks from student to student answering any individual questions they may have.

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Computer Science Gustavus Adolphus College

Since acquiring 33 NeXT computers in 1990 and 1991, the Mathematics and Computer Science Department at Gustavus Adolphus College in St. Peter, Minn., has re-shaped the curriculum and laboratory structure of its two-semester Introduction to Computer Science

The introductory courses now give students a trial experience of thinking and working like computer scientists. Instead of focusing on learning to program, students explore the role of abstraction in both program development and reasoning about computation.

To switch to an abstraction-focused curriculum, the department implemented the Structure and Interpretation of Computer Programs curriculum developed at the Massachusetts Institute of Technology. The department also abandoned Pascal programming language in favor of MIT's *Scheme* dialect of Lisp, which better supports abstraction and exploratory programming and learning.

In the first course in the revised sequence students learn how to express general procedural ideas and how to use general categories of data in terms of their operational properties.

In the second course, students learn how to use programming-language definition as an abstraction mechanism and how to implement a newly defined language by writing an interpreter in an existing language.

Instead of working on lab assignments in their spare time, students are assigned scheduled lab times when an instructor is present to assist and facilitate collaboration among classmates.

For the introductory sequence, a customized NeXT programming environment called *Schemakit*, a *Scheme* dialect of Lisp, was created. *Schematik* combines the functionalities of a text editor tailored to *Scheme* with user interface for an underlying *Scheme* interpreter. It has standard NeXTSTEP features and many *Scheme*-specific features. *Schematik* is available via anonymous FTP from ftp.gac.edu.

Partial support for this work was provided by the National Science Foundation's Instrumentation and Laboratory Improvement Program through grant #USE-915248.

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Natural Sciences California State University, Los Angeles

Robert Desharnais, assistant professor of biology, and Gary Novak, assistant professor of geology, proposed creating an interactive electronic classroom for mathematics and science students. Their proposal, "The Interactive Electronic Blackboard for Natural Science and Mathematics Education," received a \$100,000 NSF matching grant to implement the classroom that includes NeXTstation Color computers, and incorporates applications developed by faculty.

The objective is to substantially increase the retention rates of mathematics and science students, particularly those with weak academic backgrounds and English language skills. Faculty expect to achieve results of regional and national significance. Desharnais also believes that the electronic classroom will improve communication between faculty and students. Instructors in physics, geology, and chemistry are also using the classroom.

Desharnais has taught several courses, including undergraduate and graduate-level ecology and genetics using custom applications. For his genetics courses, he designed FlyLab, a simulation program that students use to design flies, mate them, and examine the offspring. It illustrates the principles of Mendelian inheritance. For his Introduction to Ecology course, he created Competition, a population simulation that demonstrates conditions under which two competing species may coexist.

Competition is based on the classical Lotka-Volterra model that describes the changes in numbers of two species by parameters: growth rates, carrying capacities (the number of animals the environment can support), and competition coefficients, defined as the percentage of overlap in use of resources by the two species. Students adjust the parameters and watch the species compete.

Desharnais is also working with a high school student, who is part of the National Science Foundation Young Scholars Program, to develop a mathematical model that charts the growth of muscles in intertidal zones. The function of the model is to determine how a high tide site affects the growth rate of muscles. The student is developing an application interface with Interface Builder.

Faculty members recently submitted another grant proposal to the NSF to support future curriculum development using NeXT technology.

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Mathematics University of Nebraska

In 1990, when Nebraska's Mathematics Department purchased a 14-station NeXT lab with a grant from the Instrumentation and Laboratory Initiative of the National Science Foundation, Dunbar immediately bid adieu to his traditional method of teaching differential equations. Gone are his daily chalkboard-based lectures and homework assignments completed on paper.

Dunbar has three uses for NeXT machines in the course. He has prepared a series of *Mathematica* Notebooks for students to review outside of class. The Notebooks explore various topics in differential equations—from finding orthogonal trajectories of a given family of curves to using the variation-of-parameters formula to solve non-homogeneous linear differential equations.

Throughout the semester-long course, Dunbar also assigns five team projects. Typically, the projects involve investigating a particular differential equation. Students are asked to discuss the physical derivation, linearization, special small-amplitude solutions, and final solution of the equation. These projects require the use of WriteNow, CharFind, Draw, and *Mathematica*.

Mathematical analysis and presentation are the core of the course. Students are not tied to one particular application for solving problems. For example, they can use *Mathematica*, a programming language, or some other application.

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Curriculum Reform in Engineering Rose-Hulman Institute of Technology

In 1989, after holding several meetings about the state of the school's curriculum, faculty members at the Rose-Hulman Institute of Technology in Terre Haute, Ind., decided to embark on an innovative redesign of the institute's first-year courses for mathematics, engineering, and physical sciences majors.

The institute received grants from the National Science Foundation, Lilly Endowment, Westinghouse Educational Foundation, and GE Educational Foundation to revamp the courses and purchase new equipment.

With more than 200 NeXT machines currently on campus, a team of seven Rose-Hulman professors teaches the integrated curriculum in several classrooms and computer labs.

Among the custom applications are PhysicsWorld, a simulation in which students investigate and visualize the motion of particles in gravitational, electrostatic, and magnetic fields; TaylorSeries, which provides an interface to Mathematica that makes it easier to explore the characteristics of the Taylor series; DataAnalyzer, which helps students plot and fit functions to data; RateLaw, which allows students to simulate the kinetics of a variety of chemical reactions; and FieldSimulator, which performs field simulations and draws electric field lines and equipotential lines to help students visualize field line and equipotential contours for electrostatic and gravitational fields.

During summer 1992, Jeffrey Froyd and 15 Rose-Hulman students plan to work with John Glover, of the University of Houston, and 12 of his engineering students to develop objects the schools and departments can share.

The Rose-Hulman students will develop objects to use in the integrated curriculum and in the institute's Fluid Sciences Learning Center while the Houston students will develop objects for its EE curriculum. The two groups will share and review documentation and code via e-mail and then suggest improvements to one another.

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Physics Davidson College

In 1991, with funding from the Keck Foundation, the National Science Foundation, and Davidson College, the Physics department founded the Davidson Center for Scientific Computation, a high-level computational facility containing 11 NeXTstations, used for advanced courses as well as faculty workshops and student research projects.

Within a week of the machines' arrival in the spring of 1991, faculty and students began experimenting with NeXTSTEP and Objective C. In the classroom, several faculty members now use custom physics applications developed by Allegheny College in Meadville, Pennsylvania; the Rose-Hulman Institute in Terre Haute, Indiana; and other institutions.

Faculty member Wolfgang Christian created a two-dimensional Ising model while a student developed a series of laser spectroscopy simulations as part of his senior thesis project.

Davidson faculty also worked with the NSF to sponsor a conference on "Computational Physics in the Undergraduate Curriculum" at the school in the fall of 1991. The meeting explored a variety of developments in computational physics, including symbolic computation, visualization, and object-oriented programming. During the conference, several attendees presented papers on physics applications they had developed on the NeXT platform. Jim Feagin, on the physics faculty at California State University, Fullerton, also led a *Mathematica* workshop, using 18 NeXT machines.

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