

NSF Funding Opportunities for Two-Year College Mathematics

AMATYC National Convention
Friday, November 10, 2000
Chicago, Illinois
Elizabeth J. Teles
Program Director for Mathematics
Division of Undergraduate Education
National Science Foundation

Division of Undergraduate Education Anticipated Closing Dates FY 01

- **Course, Curriculum, and Laboratory Improvement (CCLI)** June 4, 2001
- **Advanced Technological Education (ATE)**
 - Preliminary Proposals April 26, 2001
 - Formal Proposals October 19, 2001
- **Computer Science, Engineering, and Mathematics Scholarships (CSEMS)**
 - Letters of Intent Late February (optional)
 - Proposals April 4, 2001

Course, Curriculum, and Laboratory Improvement Program (CCLI)

- Purpose is to revitalize and improve the quality of undergraduate science, mathematics, engineering, and technology education obtained by all students at all types of institutions
- Three tracks emphasizing
 - Development of new materials and practices
 - Adaptation and implementation of previously developed exemplary materials and practices
 - National dissemination of exemplary materials and practices

Vision for Undergraduate Education:

*All students have access to supportive,
excellent undergraduate education in SMET
and all students learn these subjects by
direct experience with the methods and
processes of inquiry.*

Shaping the Future (1996) AND From Analysis to Action (1996)

Course, Curriculum, and Laboratory Improvement Program (CCLI)

- **Educational Materials Development (EMD)**
 - Proof-of-Concept (up to \$75 K)
 - Full Development (up to \$500K)
- **Adaptation and Implementation (A & I)**
 - Course/Laboratory (Up to \$100 K)
 - Comprehensive Curriculum (Up to \$200K)
- **National Dissemination (ND)**
 - Large Scale Faculty Professional Development

CCLI: Educational Materials Development (EMD) Track

**Encourages the creation of
innovative educational materials
(electronic, print, multi-media,
equipment) appropriate for national
distribution, adaptation, and
implementation.**

Outcomes Expected from Full Development (up to \$500K)

- Innovative materials for national distribution
- Teaching and learning strategies that are demonstrated to be effective at diverse sites
- Effective national dissemination and faculty professional development in the use of the materials and pedagogies
- Establishment of commercial, or other, self-sustaining distribution



Interactive Software to Improve Student Success in Developmental Mathematics

Bunker Hill Community College
PI: Joanne Manville

DUE9950568
CCLI EMD Award: \$107,246

Materials development to address problem and perception of mathematics as memorization of formulas

Student success strategies incorporated into the model

Producing companion instructors' resource guide and a series of "Success in Mathematics" modules

Collaboration with MA College of Art



Workshop Precalculus: Developing Pedagogically Powerful Instructional Materials for an Integrated Course in Functions, Data Analysis, and Modeling

Dickinson College
PI: Nancy Baxter
Award: \$496,445

DUE 9952483
CCLI EMD

Materials development to assure that students develop a firm understanding of function concept and interplay of functions and data analysis, modeling, and problem solving.

Comprehensive dissemination program includes publication of a book and summer seminars and workshops for faculty who wish to teach the course

Course, Curriculum and Laboratory Improvement:

• Educational Materials Development

– Proof-of-Concept (up to \$75K)

- demonstration of the scientific, educational, and commercial merit of an idea or concept,
- results may serve as the basis for full-scale-development project,
- results include prototype, plan for further development, identification of test sites, plans for self-sustainability



Integrating Mathematics and Biology: A Case Studies Approach to Linear Algebra

Hope College
PI: Janet Andersen
Award: \$ 71,115

DUE 0089021
CCLI EMD POC

Developing an integrated mathematics and biology course that teaches linear algebra concepts in the context of biological case studies.

Strengthening the mathematical skills of biology majors and the exposing mathematics students to mathematical models used in biology.

Mathematics and biology students work together on case studies, group projects, and presentations

CCLI (A&I) Track



Promotes the improvement of undergraduate SMET education through the adaptation and implementation of effective materials, techniques, and practices to result in positive change at an institution

Requires 1:1 match on all costs

Outcomes Expected from A&I Projects

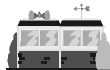
- Adaptation and implementation of innovative practices and materials
- Faculty professional development
- Initiation of efforts to broaden the impact at the institution
- Evaluation of the effectiveness of the project
- A model of effective implementation

A&I Projects



- Identify explicit materials and practices that will be adapted and implemented (may come from more than one source)
- Incorporate laboratory experiments and/or field experiences
- Adapt exemplary materials to a significantly different student audience
- Use new resources such as instructional and information technologies

Institutional Impact



- The proposal should demonstrate how the project fits into departmental and institutional goals
- Will the department or institution build on the result of the project?



Preparing Elementary Mathematics Teachers for Success: Implementing a Research-Based Mathematics Curricula

Eastern Michigan University
Adaptation and Implementation \$97,355

CCLI Mathematics
DUE 9950679

- Adapting and implementing the Treisman Workshop Model and NSF K-12 mathematics materials to four courses in teacher preparation programs
- Involving cross-disciplinary teams of faculty from Eastern Michigan University, Henry Ford Community College, and Schoolcraft College
- Assuring changes in students' content knowledge in mathematics, problem solving ability, and attitudes



Multicampus Science, Mathematics, and Technology Reform

SUNY Oswego
Adaptation and Implementation \$ 199,979

CCLI Mathematics
DUE 9950803

- Adapting and implementing materials and educational practices developed primarily under the NSF Mathematics Across the Curriculum projects
- Involving teams of faculty from seven colleges (two- and four-year institutions)
- Integrating inquiry-based learning, mathematical modeling, and technology into the mathematics curriculum



A Collaborative Strategy for Curriculum Reform and Faculty Development

Arapahoe Community College
Adaptation and Implementation \$ 57,926

CCLI Mathematics
DUE 9952700

- Adapting and implementing materials and educational practices developed by Math Center at University of Colorado and KY Com. Col. Calculus Institute
- Establishing a computer classroom and upgrading and expanding tutorial and laboratory services for mathematics students
- Providing opportunities for new methods, course materials, and faculty development



Improving Student Learning in Calculus Through Effective Implementation of Model Activities

Gadsden State Community College DUE 9950763
PI: Mary Ann Misko CCLI A&I
Award: \$87,185

Collaboration with U of Alabama & Duke U to create an effective learning atmosphere for students
Addresses three problems: limited lab facilities; low student success rates in Calculus I; low persistence rates in calculus series
Targets women, minorities, math education majors
Partnership with local magnet high school and two universities for professional development of high school and college faculty

One of Most Creative Adaptation and Implementations of All Time. Do you know who this group is?



Photo of Calculus I 1990

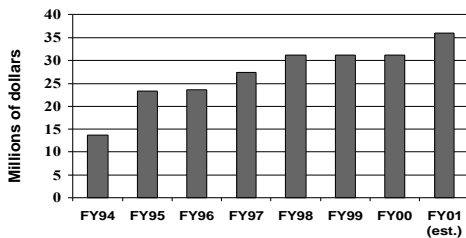
Paul Allen and Williams Gates III had heard that IBM, about to market its first PC, needed some nuts-and-bolts system code. The Seattle pals pooled \$50,000 to buy an existing piece of software that they tweaked and retitled MicroSoft Disk Operating System. Big Blue gave the kids a break and licensed it.

ADVANCED TECHNOLOGICAL EDUCATION

DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES

Division of Undergraduate Education
Division of Elementary, Secondary, and Informal Education

ATE Program Budget



Advanced Technological Education

- Assures that students acquire appropriate backgrounds in mathematics and science
- Supports development of science and engineering technology courses with the assumption that students have strong backgrounds
- Works on partnerships among 2-year colleges, secondary schools, 4-year colleges and universities, business, industry, and government



Curriculum Development



- Science, Mathematics, and Engineering Core Courses
- Science and Engineering Technology Courses with Expectation that Students Have Appropriate Backgrounds
- Assessment of Student Learning
- Product Oriented Approach
- Student Experiences with Appropriate Equipment
- Use of Modern Instructional Media
- Instructional Approaches which use such Activities as Student Writing, Oral Presentations, Group Learning Experiences, and Long Term Projects

Program Improvement



- Preparation and Enhancement of Faculty
- Alliances with Business, Government, and Industry
- Recruitment, Retention, and Placement of Students
- Improved Guidance for Students
- Articulation of Programs
- Innovative Partnerships for Design and Dissemination of Materials
- Project Evaluation
- Professionalization of Technician Careers

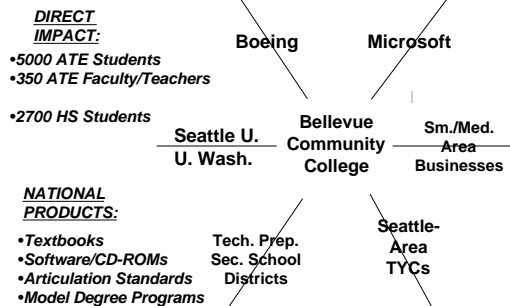


Advanced Technological Education Program

- New Emphases: Regional Centers and Articulation
- Projects which focus on one or more aspects of: Curriculum and Instructional Material Development; Adaptation and Implementation Teacher and Faculty Preparation and Enhancement; Technical Experiences for Students; or Instrumentation and Laboratory Improvement.
- Centers of Excellence
- A few special projects

ATE PROGRAM - Centers for Excellence

Northwest Center in Information Technology



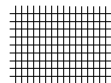
South Carolina Advanced Technological Education Center of Excellence

South Carolina Technical College System
P.I.: Elaine Craft

DUE 9602440, 9908409
ATE Center

Award: \$2,100,000 + \$3,000,000

- Partnering with BellSouth, Michelin, Bose, Robert Bosch, NCR and many other businesses and industries
- Developing integrated engineering core curriculum using a systems-based approach.
- Providing faculty development opportunities that emphasizes the use of interdisciplinary and intercampus teams for designing and implementing curricula reforms.
- A collaboration between 2- and 4-year colleges, universities, industry, Tech Prep consortia, and SC State Systemic Initiative
- Primary audience is technical college students currently enrolled in or desiring to enroll in engineering technology programs.



Computer Simulation of Industrial Statistical Applications for Undergraduates and Technicians

Lane Community College
P.I.: David Shellabarger
Award : \$ 262,800

DUE 9752058
ATE Project

- Preparing technicians for high performance workplaces.
- Providing world-of-work contexts for learning statistics and introducing students to technical fields and workplaces.
- Creating new courseware and making it available to other schools and training programs.
- Partnering with regional manufacturers, a professional statistician, and a quality control engineer.



NASA-AMATYC Laboratory Technical Activity

Capital Community Technical College
P.I.: John Pazdar
Award : \$ 125,000

DUE 9850244
ATE Project

- Collaboration among two-year college mathematics faculty in teams of two with Kennedy Space Center scientists and engineers
- Production of 10 Laboratory Technical Activities and 20 Spin-off activities
- Dissemination via book distributed to AMATYC members and by request and via the Web



Using Case Studies to Strengthen Mathematics in ATE Programs

Bronx Community College
P.I.: Susan Forman
Award : \$ 187,459

DUE 9713869
ATE Project

- Investigated mathematics in ATE projects in such areas as manufacturing, agriculture, GIS, and image processing.
- Documented the critical role mathematics plays in science and engineering technology
- Worked with the American Association of Community Colleges to published a research brief entitled *Why Math?*



Developmental Mathematics and Its Applications (DevMap) Project

COMAP
P.I.: Solomon Garfunkel and Susan Forman
Award : \$ 674,677

DUE 9950036
ATE Project

- Students are building their mathematical skills and their confidence to solve challenging problems.
- The book being written is an alternative approach to elementary and intermediate algebra and also includes topics from geometry and trigonometry
- The materials are applications-based.
- Technology is integrated into materials.



Integrated Mathematics and Physics for Technical Programs

Wake Technical Community College
P.I.: Robert Kimball
Award : \$ 119,999 + \$231,043

DUE 9752038, 9950101
ATE Project

- Integrating mathematics and physics to strengthen students' skills at applying mathematical concepts & better prepare students for highly technical workplaces.
- Using physical models to motivate study of mathematics.
- Teaching students to work collaboratively, use technology, communicate, and problem solve.
- Second grant to prepare a resource package of integrated mathematics and physics activities.

Technical Mathematics for Tomorrow: Recommendations and Exemplary Program



AMATYC
P.I.: Mary Ann Hovis
Award : \$ 269,956

DUE 0003065
ATE Project

- Analyzing the role and nature of technical mathematics in advanced technology programs
- Recognizing successful models
- Developing a vision and recommendations for the future
- Bringing together mathematics and technical program faculty together with business and industry to address content and curriculum issues

SCANS Competencies *

* Secretary of Labor's Commission on Achieving Necessary Skills

• Workplace Competencies

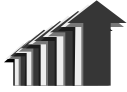
- Resources
- Interpersonal Skills
- Information
- Systems
- Technology



• Foundation Skills

- Basic Skills
- Thinking Skills
- Personal Qualities





New Emphases in 2000 for Fiscal Year 2001

- Regional Centers for Manufacturing or Information Technology Education
- Articulation Partnerships Between Two-Year Colleges and Four-Year Colleges and Universities
 - Teacher Preparation
 - Associate to Baccalaureate Programs



Articulation Between Associate's Degree and Bachelor's Degree Programs

Projects might involve:

- Transitions from 2-yr science or technology degree programs to 4-yr science or technology programs from which graduates enter workforce as technicians
- Transitions from 2-year science technology degree programs to 4-yr engineering or computer science degree programs



Articulation Between Associate's Degree and Bachelor's Degree Programs

Projects might involve:

- "Reverse transfer" arrangements where 4-yr degree students take technical programs in 2-yr colleges before or after graduation.
- Programs that encourage joint activities between students in programs with different educational requirements

Investing in Tomorrow's Teachers: The Integral Role of Two-Year Colleges in the Science and Mathematics Preparation of Future Teachers

- **"It has become increasingly apparent that the resources of the nation's community colleges must be utilized fully if the need for a teaching force well-prepared in science, mathematics, engineering and technology (SMET) is to be met." (NSF 99-49)**

"Teaching is the essential profession. Without good teachers, the highest standards in the world will not ensure that our children are prepared to be the nation's future scientists, or productive citizens... More than ever before in our history, education is the fault line between those who will prosper in the new economy and those who will be left behind."

William Jefferson Clinton
Presidential State of the Union Address 1997

Investing in Tomorrow's Teachers

Recommended Actions for

- Recruitment of Prospective Teachers
- Strengthening undergraduate science, mathematics, engineering, and technology courses
- Pre-teaching experiences
- In-service activities
- Liaisons between two-year colleges and four-year institutions
- Connections with business and industry, professional societies, and organizations

Sample Recommendations

Two-year colleges should:

- Recruit and attract the best students to the SMET teaching
- Include teacher preparation efforts into colleges' mission and strategic plans
- Provide professional development in SMET both within and across disciplines for full and part-time faculty

Sample Recommendations

Two-year colleges should collaborate with four-year institutions and school systems to:

- Coordinate advising for prospective teachers
- Eliminate barriers for course transferability by articulating transfer agreements
- Design and implement high-quality SMET curricula
- Engage potential teachers in preK-12 tutoring, mentoring, and enrichment programs in SMET fields



Teacher Preparation in Two-Year Colleges



All proposals must involve 2 and 4-year institutions and should aim to:

- Increase number, quality, and diversity of prospective K-12 teachers in preprofessional programs in two-year colleges.
- Improve technological literacy of prospective K-12 teachers at all levels and their understanding of the modern workplace.
- Strengthen prospective K-12 teachers' preparation in mathematics and science.



Teacher Preparation in Two-Year Colleges



Projects should focus on activities such as:

- Recruiting students into careers as SMT teachers.
- Establishing or enhancing the infrastructure of 2-yr college programs for prospective teachers.
- Developing or adapting high quality SMET materials, courses, and methods for 2-yr college courses that serve prospective teachers
- Engaging pre- and in-service teachers in joint activities
- Connecting 2-yr college programs for prospective teachers with business and industry, etc.

Project Teach: Teacher Education Alliance of Colleges and High Schools

Green River Community College
S433,858

Teacher Preparation
DUE 9876589

- Links high schools, community colleges, and university programs
- Seeks to improve the preparation of future teachers especially in mathematics and science
- Recruits students into teaching, focusing on underrepresented groups
- Improves preparation and retention through para-professional and pre-professional programs
- Supports mentor and beginning teachers through shared inservice opportunities

Computer Science, Engineering, and Mathematics Scholarships (CSEMS) Program

The CSEMS Program provides institutional awards for student scholarships of up to \$3125 per year to encourage and enable the achievement of higher education degrees in computer science, computer technology, engineering, engineering technology, or mathematics by talented but financially disadvantaged students.

Using Computer Science, Engineering, and Mathematics Scholarships to Build Information Technology Resources

College of DuPage
PI: Capetta

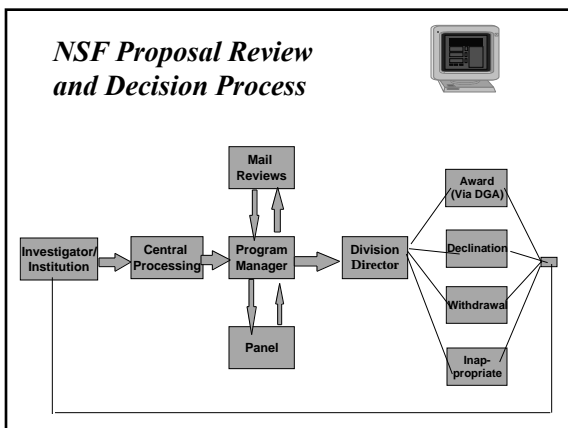
DUE 9986956
CSEMS \$219,874

- Expands and improves learning opportunities for students enrolled in CSEM
- Increases retention to associate degree achievement
- Improves placement in baccalaureate programs
- Expands partnerships with employment sector
- Implements recruitment strategies for groups underrepresented in CSEM.
- Targets both high school and adult learners

Preliminary FY00 Award Information

- The CSEMS program received 284 proposals for the first round of competition.
- In FY2000, ~\$21 million is expected to be available which would allow us to support approximately 100 CSEMS awards.
- Anticipated support of 31 or 55 (56%) of proposals from two-year colleges
- An “typical” award is for \$220,000 (now raised to \$270,000 if desired), enabling support for 40 students a year, for two years.

NSF Proposal Review and Decision Process



DUE Review Panels



- Panels based on proposal load by discipline
- Panelists selected for expertise in undergraduate education in a particular discipline or across disciplines
- Distribution sought with regard to
 - Rank and tenure status
 - Years of teaching, administrative, or industrial experience
 - Experience as a review panelist
 - Experience as a grant holder
 - Gender
 - Race/ethnicity
 - Type of institution for those employed in academia

The Proposal: Criteria for Evaluation

Peer Reviewed

Criteria for Evaluation

1. What is the intellectual merit of the proposed activity?
2. What are the broader impacts of the proposed activity?

Intellectual Merit



- Major challenge addressed
- Goals and objectives innovative, well-developed, realistic, worthwhile
- Target audience considered
- Capable and experienced faculty
- Adequate facilities and institutional commitment

Intellectual Merit as Applied to ATE



- Addresses a major challenge
- Supported by capable faculty and others
- Improved student learning
- Rationale and vision clearly articulated
- Informed by other projects
- Effective evaluation and dissemination
- Adequate facilities, resources, and commitment
- Institutional support

Broader Impacts



- Contribution to the knowledge base of activities to enhance student learning
- Usefulness at similar institutions
- Potential for widespread impact and dissemination of products

Broader Impacts as Applied to ATE



- Address current and future needs of industry
- Enhance the status of technician education
- Integrated into academic programs
- Contribute to knowledge base and useful to other institutions
- Widely used products which can be disseminated
- Improved content and pedagogy for faculty and teachers

WHAT MAKES A GOOD PROJECT?



INNOVATIVE
REALISTIC
WORTHWHILE
WELL-PLANNED

Key Role of Faculty



- Teacher is a key player.
- Administrative support is essential.
- Opportunities for faculty to continue to learn are necessary.
- Faculty and administrators must both provide and look for ways to link with others in academia (K-16 and beyond), business, industry, and government.

WAYS TO PARTICIPATE



- Grant Holder
 - Principal Investigator
 - Member of Project Team
 - Member of a coalition
 - Member of an Advisory Board
 - Test Site
- User of Products
- Participant in Workshops and Symposium
- Reviewer of Proposals

Information and Inquires

- **DUE Information System**
 - Email undergrad@nsf.gov
 - Phone 703-292-8670
 - Fax 703-292-9015
- **DUE Web Site** <http://www.ehr.nsf.gov/EHR/DUE/>
- **DUE Project Information Resource System**
<http://www.ehr.nsf.gov/PIRSWeb/Search/>
- **DUE Mailing Address**
 - NSF, Division of Undergraduate Education, 4201
Wilson Boulevard, Room 835, Arlington, VA 22203

**Bye for Now! Hope to See
You Again Soon!!!**

