Center for Innovation in Learning

Application for Course Transformation Grant
Due March 20, 1998

Email One PDF version of your proposal to cil@vt.edu
AND
Mail 12 paper copies to:
Anne Moore, 332 Burruss, 0169

Date March 20, 1998

Proposal Category

_X_ Distance Learning Program

_X_ Core Curriculum Courses

_X_ Upper Level Undergraduate and Professional Courses

_X_ Multiple Use Courses

Title of Proposal   Remote help for computer-based math courses

Faculty Name(s)   Frank Quinn (contact)

E-mail: quinn@math.vt.edu
Telephone: 1-8274   **Fax:**   1-5960

Department(s)   Mathematics
Mail Code: 0123

College(s) Arts and Sciences

Course No.
(For distance learning programs, please attach description of program and list of courses)

>   Emporium only (fall 1998):
>   Math 1015   Elementary calculus with trigonometry
>   Math 1205   Calculus
>   Math 1206   Calculus
>   Math 1224   Vector geometry
>   Math 1614   Numbers and computation for teachers
>   Emporium and Northern Virginia (fall 1998)
>   Math 1114   Elementary linear algebra

Math 4554   Numerical methods for engineers
Math 4564   Operational methods for engineers

Projected Enrollment
Total using the Emporium, fall 1998: 5,100
Subtotal using Mathematica in the Emporium: 2,300
Northern Virginia enrollment unknown.

Project Abstract (maximum 250 words, for public release)

In this proposal the Department of Mathematics requests funds for development of fast web-based access to faculty help for students at computer work areas.

The Department is converting many of its on-campus courses to computer-based formats to be offered in the Math Emporium. These will also be offered off-campus at sites including the Northern Virginia center and Virginia State University. This can be successful only if we can provide students with fast personal help when they encounter difficulties. Basic help can and should be delivered by personnel physically present at the work area, but economic considerations require most help, including specialized help in the Emporium, to be offered over the network from a remote location. This abstract point has been clear for some time, and the original course development proposals included videoconferencing and similar help facilities. However our understanding of what students actually need has evolved a lot over the last year, and the first guesses now seem off the mark. As a result development of help facilities is lagging behind courseware. It is imperative to get them back on the same schedule. This project will refine and field-test new approaches, and begin deployment when a successful system has been developed.

Proposal Narrative

1. The current situation

Recent developments have generated an urgent need for effective on-line help facilities for mathematics courses.
- The Department is committed to conversion of a large part of its on-campus offerings to computer-based courses in the Math Emporium.
- The University in general, and the Department in particular, are committed to greatly expanding technological course offerings at the Northern Virginia center.
- The Department is collaborating with Virginia State to develop a distance-learning program linking the two departments.
- Several high schools have expressed interest in offering Virginia Tech computer-based math courses to their students. A trial program will be conducted this fall at a school near the Northern Virginia center. Similar opportunities may develop at community colleges.

Experience in the Emporium this past year has considerably sharpened our understanding of what students need. Effective help seems to have the following features:
- Speed. When students get really stuck they ask for help. Any delay between the request and delivery is frustrating wasted time. In the Emporium help is often available within ten seconds of a request.
- Emphasis on diagnosis. A help session begins with a careful diagnosis of the problem. Students often misdiagnose their difficulties, and this must be overcome. The helper must then determine what sort of response will be helpful to the student. Frequently the response itself takes only a small part of the total time of the session.
- On-location. Help is delivered to the student, not vice-versa. When software is involved the helper usually needs access to the student's machine to be able to diagnose difficulties. Also, the objective is to enable the student to continue with the task once the problem is resolved.
- Transparency. The help process itself should intrude as little as possible. The emphasis should be on the problem and solution, not on communications between helper and student.

2. Proposed activities

The system under development has a helper at a "command post" and a student at a specially configured work station. We will experiment with various configurations of software and hardware to find an effective combination. The starting point includes:
- Mirroring software to reproduce the student's screen on the helper's screen, and permit the helper to move the cursor and enter text.
- An audio link for two-way voice communications.

- A document imaging camera at the student work station, to enable the helper to see texts and written material.

Scaling costs are an important constraint. Help must be available where the students work, and there will be hundreds of work areas. Thus we must carefully identify what is genuinely necessary, and avoid frills. For example it would be nice to have a document imaging camera at the help station, to transmit images to the student. However this would probably require a second monitor at the student location, and we do not expect the convenience to justify the additional expense. Similarly, video pictures of the helper and student would be nice, but are not worth the substantial additional costs.

Preliminary tests suggest that the "Network Assistant" software will provide the screen mirroring needed. We are testing document-imaging cameras starting at the low end. We have tested a Connectix QuickCam VC and this does not have sufficient resolution. Unfortunately the next level of resolution is substantially more expensive, currently in the $500 range.

The plan is to test components until a promising configuration is attained. Then we will set up twelve stations in the Emporium to "field-test" the equipment and learn to use it in real-life situations. When this stage is satisfactorily completed we will begin full-scale deployment.

The first target for on-line help will be Mathematica assignments in 1205, 1206, and 1224 (projected fall enrollment 2,300). Reasons for this emphasis are:
- It is our greatest current need. Most of the help required for other courses can be effectively provided by current help staff, but Mathematica problems often exceed their expertise.
- The problems involve software, so can be effectively diagnosed through screen mirroring and remote control of the student machine.
- Students coming to the Emporium to work on Mathematica assignments can be easily identifiedand directed to help-configured work areas.

3. Benefits to students and faculty

Computer labs without help facilities tend to become game rooms and surf stations. Learning doesn't happen without help, and the better the help the more effective the learning environment. This project should significantly advance the faculty's ablity to offer expert help, so should lead to improvements in the following areas.
- Students will be able to progress steadily and efficiently through course material.
- Learning experiences will be more positive, since delays and frustrations will be reduced.
- By centralizing and speeding the help process it will significantly leverage faculty expertise.

- Increased faculty efficiency will contribute to the University goals for increased productivity.

4. Project Timeline

Spring 1998
- Test software and equipment to develop a satisfactory configuration.
- Test in simulated help situations, with faculty playing the role of students.

Summer 1998
- Set up twelve student work areas in the Emporium, before the beginning of summer term.
- Provide "semi-remote" help to students in summer courses: begin on-line, but from a physically nearby area so direct help is possible if the on-line process bogs down.
- Work extensively to develop effective procedures and materials, and complete the integration of software and equipment.

August 1998
- Add at least fifteen more remote-assisted work areas in the Emporium.
- Set up sixteen remote-assisted work areas in the Northern Virginia center. The on-line help would be provided by faculty working in the Emporium, but some training of on-site personnel would be necessary.
- As funding and circumstances permit, set up additional areas at Virginia State and/or high schools.

Fall 1998
- Continue development of materials and procedures.
- Interact with courseware developers, so course materials are well-adapted to the help environment.
- Train additional faculty in providing remote help with this system.

5. Personnel

This project will be a team effort involving many faculty and student s already experienced in helping in a computer-based environment. The project will be administered by Robert Olin. Development will be directed by Frank Quinn and Charles Hodges. Development will include:
- Identify software and equipment for testing.
- Develop and test configurations in spring and summer 1998.
- Develop support and training materials for helpers.
- Oversee setup and training at off-campus locations.

Equipment acquisition and inventory will be done by Ken Hinson, Director of the Departmental computer support group. Equipment and software setup will be done by Emporium staff, including Richard Diz.

Frank Quinn has been involved with computer-aided instruction for over 25 years, and has developed course materials for calculus, calculus of several variables, introduction to proofs, and linear algebra. This semester he is working with the CIL-funded courseware development group led by Robert Rogers. Last semester he worked as a supervisor and helper in the Emporium, and wrote the supervisor's manual.

Charles Hodges has taught computer-aided math courses for the last eight years, and developed materials for calculus and differential equations courses. He taught our first web/Emporium-based course in summer 1997, and helped develop the procedures currently in use. All of his duties in the 1997-98 academic year, including tutoring, help, and test database development, have been in the Emporium. This summer he will teach a CyberSchool section of Math 1114 (elementary linear algebra).

6. Assessment plan

Specific measures of success of the project are:
- Timely completion of development and deployment, as described in the Project Timeline.
- Satisfactory resolution of 90% of referred problems with Mathematica assignments in 1205, 1206, and 1224 by the end of the fall semester, 1998.
- Economic viability, both in terms of equipment costs and faculty time committments, of the final configuration.

All methods of providing help in the Emporium will be actively assessed. Current tools include student response cards, on-line surveys, and interviews. These methods, and new ones as they are developed, will be applied to on-line help. The measures of success appropriate to these assessments is:
- In the Emporium, greater student satisfaction with on-line help than with the level of direct help that could be achieved with the same committment of faculty time.
- At remote locations, student acceptance and use of on-line help, and steady progress through their assignments.