DEMOS WITH POSITIVE IMPACT

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DEMOS with **POSITIVE IMPACT** is a project to connect mathematics professors with effective teaching tools. This is a preliminary report on work-in-progress and an invitation to participate in the project.

At our universities, most of our teaching is 'instructor centered' and classroom instruction is primarily delivered in a lecture format. We believe this is still true at most colleges and universities. This mode of instruction requires that we carefully select what we deliver and how we deliver it. We use a variety of techniques to get students to tune-in to mathematics. This project focuses on **demonstrations** that use some form of **instructional technology**. For the purpose of this report, we use the following broad descriptions.

- **Instructional technology:** any tool used to facilitate a learning process, including physical equipment, graphical displays, simulations, data manipulation, calculators, computers and computer software, the web.

- **Demonstration:** a description or explanation of an idea, concept, or process illustrated with some form of instructional technology.

What we have in mind is a vignette incorporated within a lecture that engages the learner on a level beyond that created by the dialogue of the instructor. In contrast to student activities such as projects or lab activities, these vignettes are intended to be presented by the instructor.

The time we spend in our classes is extremely short compared to the mass of information our students need to learn. This makes the time we use for any demonstrations all the more precious, especially if we take the extra step to incorporate some form of technology into the lesson. Just the availability of technology does not guarantee increased student understanding. Thus, choosing topics for which we can develop effective demonstrations and determining how to efficiently incorporate them into our presentations is particularly important.

Reform in undergraduate mathematics education and the availability of a variety of technologies has changed the way we teach and has increased the flexibility we have in developing lessons. Instructional technologies provide a vehicle for developing meaningful demonstrations that contribute in a positive way to student understanding. Adding demonstrations to classroom presentations provide opportunities for the visual learner as well as the auditory learner. Thus demonstrations provide a double-barreled delivery vehicle for learning.

Issues and Scope

A demonstration is constructed to highlight a point, an idea, a concept, or a particular piece of information. It is used to emphasize something the instructor feels students need to 'record' in some way. There are many distractions which can infringe on constructing an accurate record of the information, so the demonstrations we choose must be designed is such a way that learning remains on track. We emphasize the use of instructional technology for DEMOS with POSITIVE IMPACT because technology provides great flexibility for the instructor when creating a demo and for the student through visualization components inherent in technologies.

In some sense 'technology' is whatever an instructor is comfortable using and is conveniently available. Thus the technology of the day might be a physical object rather than a computer display. There are many avenues we can take to get a point across. By collecting many types of demonstrations, we hope to create a useful resource that appeals to a wide variety of teaching styles and learning styles. With this in mind, we propose the following classification scheme for a demonstration database:

- Physical (objects used to illustrate a concept)
- Data based (observations are made based on real data)
- Calculator
- Computer software
- Web based

Within this classification scheme, we plan to include demos from precalculus, calculus, and post calculus areas from the undergraduate mathematics curriculum.

There are many issues to consider when selecting or developing instructional demonstrations including topic selection, construction format, delivery, timing, student interaction, and the assessment on student learning. While this project cannot address all of these issues in detail, we hope to provide a conduit for sharing information about successes, as well as point out topics that have been troublesome. We also wish to include comments from developers and users to provide background and first-hand observations.

Examples of Demos

We presented four examples from the current submissions.

> My Favorite Mug (A physical demo for calculus using Simpson's Rule and volumes of surfaces of revolution.)

> A Colorful Linear Combination Demo (A software demo in MATLAB using RGB colors to illustrate linear combinations in which the coefficients are color intensities.)

> Matrix-Vector Multiplication Demo (An animated demo using a java applets.)

> Sound in Differential Equations Demo (A software demo in MATLAB using sound and graphics to hear/display the solutions to the differential equations of mechanical vibrations.)

These examples are available for inspection on the web at

http://www2.gasou.edu/facstaff/lroberts/demos/demoimpact.html

Solicitation for Participation

If you have a demo that has worked effectively in your instruction, then you have enhanced both the achievement and learning attitude of your students. We invite you to share your accomplishment with colleagues and other educators.

Summary

Carefully selected demos are a valuable resource. We hope to make such resources available to a wide audience. We have had some initial talks with the Math Forum at Swarthmore concerning access to the database we have in mind. Please participate yourself and encourage others to contribute.

We feel that this project has excellent potential for support of undergraduate mathematics education ranging from the integration with Project NEXT fellows to the training of TAs.

Post Note

We handed out a hard copy submission form that participants could complete and mail to us. In addition, we have an on-line web submission form that is accessible through the URL given above. We had time at the end of our presentation to discuss the project and its goals with the attendees. They gave us some good ideas and encouraged us to pursue this line of development.