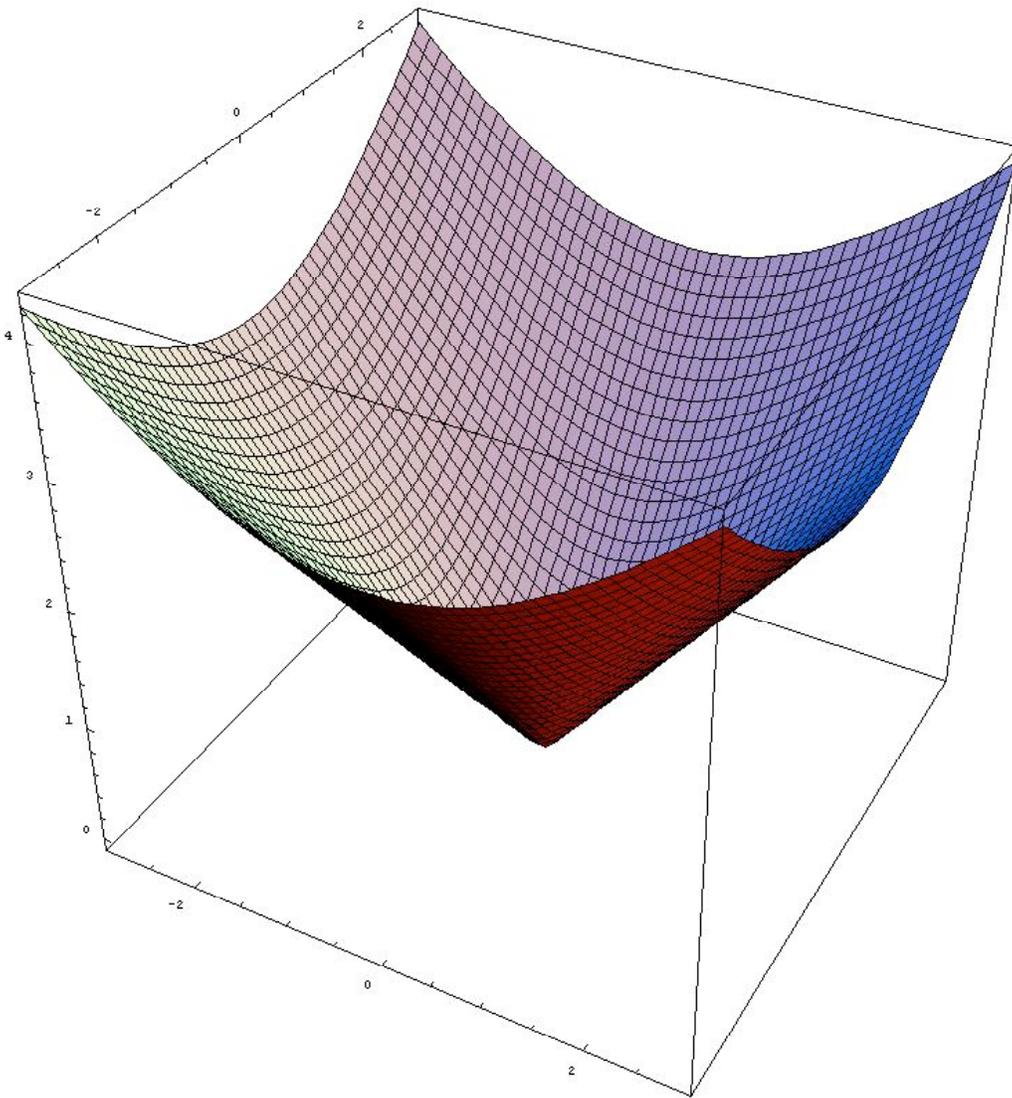


# Math Laboratory

## Where Numbers Come ALIVE !



**ETEC 442 June 8, 2005**  
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## Goal Statement

Conceptualizing mathematical ideas stimulates the growth of analytical thought, which is critical for succeeding in the modern world. Funding of \$15,000 will help us achieve this goal by allowing our high school to equip our math lab fully with 11 personal computers, 30 TI-84 Plus graphing calculators, the TI Navigator system to network them, and a projector to aid in class presentation. This high school lab will support Algebra I & II, Geometry, Pre-Calculus, and Calculus teachers.

This configuration and the utilization of appropriate technology will support the visual presentation of mathematical ideas. *Student outcomes:* student's learning will improve, cooperative activities will be supported Students will be able to tie abstract mathematical concepts to their visual models, and use technology to bolster their conceptual understanding of mathematics. This conceptual understanding will better enable students to handle logical and complex information throughout their lives. Skills in the area of logical and complex thinking are the keys to success in many areas of research as well as in the business domain.

## Need Statement

Being able to use logic and understand complex information is critical to success in today's world. Mathematics is one of the primary ways logic and critical thought is taught. The slower, paper based methods of working math problems often get in the way of understanding complex problems. Students learn to solve problems by learning formulas and algorithms, but often fail to see the big picture. High school math students need a lab environment that will encourage them think about what math conceptually.

To make room for the proposed technology, an existing classroom will be converted to a mathematics laboratory. The existing furniture will be utilized and rearranged to suit the purposes of the lab. There is no existing hardware in the room; only a pull down screen exists.

This space will be fitted with technology that addresses several teacher and student instructional needs. First, different students' learning styles require that information be presented in different ways. The lab will foster the use of diverse teaching techniques to accommodate oral, visual, and kinetic learning styles, allowing students to learn the logical and critical thinking skills that are developed in math instruction.

Secondly, teachers need tools that will allow them to monitor and support the students' learning and to teach in ways that enhance the learning environment. The proposed technology will provide teachers with an advanced system for giving feedback and will encourage teaching methods that are active and collaborative in nature.

Thirdly, to better prepare our students for their high tech world, it is important to teach them to use technology. This preparation will develop students' technological skills and help them in their work lives. Their experiences in the proposed lab will allow them to comfortably use technology as a creative solution to complex problems.

Lastly, the technological advantage gained in comparison with a traditional classroom setting is that student has greater control over their own learning and can share what they have learned with the class immediately. Peer instruction and class presentations that can be done quickly and easily change the nature of the classroom and supports learning that can grow seamlessly with the classes needs.

Without this new technology funding, gaining a conceptual understanding of mathematics will be more difficult because:

- 1) the learning of higher-level material will be limited by complex computations, a roadblock for many students.
- 2) student project demonstrations will be limited to verbal presentations with static print tools, which will be a roadblock in future work.
- 3) collaborative work will be much difficult without the capability of the networked system.
- 4) the lack of internet access and other dynamic fact verifying tools means students will be limited to out-of-date static print tools to verify facts and would not develop skills needed for the work world.
- 5) teacher demonstrations will be limited to verbal discussions of what the he or she can draw on the board, a highly inferior way to demonstrate a mathematical concept in class discussion.

## Curriculum Applications

In Algebra 1, graphing is introduced for the first time. Subsequent math courses, such as Algebra 2, Pre-Calculus, and Calculus rely heavily on graphing. The current curricula for these classes are designed to allow students to understand mathematic concepts without getting lost in the details of the process. The addition of the TI-84 Plus graphic calculator and TI-Navigating system to the classroom will expedite this process in ways that are engaging and appeal to today's high school math student.

A. The TI-84 graphing calculator is extremely useful in many learning situations encountered in Algebra 1. It:

- 1) allows students to learn the behavior of graphs more quickly and conceptually by keeping them from being bogged down in the details.
- 2) facilitates the learning of higher-level material by simplifying the computations they have done before.
- 3) connects with the computer to aid in project presentations
- 4) quickly fact checks work.

B. The calculator is certainly a useful classroom tool, but when teamed with the TI Navigator system, it becomes even more powerful. The Navigator system:

- 1) Provides interconnectivity using classroom calculators, allowing teachers and students to communicate in real time both locally and on displays they can all see.
- 2) Allows for timely assessment by allowing teachers to poll students to gauge understanding of a concept.
- 3) Lets teachers to make sure students are on task by checking their calculator screens.
- 4) Immediately compiles and analyzes results of assessments given.
- 5) Can be used with prepared materials from TI and Prentice Hall.

C. A projector, such as the TI Presenter, makes the most of these two technologies, by allowing students to interact with the entire class. The TI Presenter:

- 1) Visually demonstrates a mathematical concept in class discussion.
- 2) Allows both teacher and student to present findings to the entire class.
- 3) With the TI Navigator hardware and software, allows students have a shared visual workspace.
- 4) Teachers can send data directly to the students' calculators and students can submit their work directly.

D. Keyboards, and cradles for the calculators will allow students to use their calculators for taking notes in class. These notes can then be downloaded to the PCs. They can also review, edit, and save assignments, instructions, and other documents provided by the teacher

E. Classroom computers work with the calculator, but are useful for many other classroom purposes. Students will use the PCs to:

- 1) Work together on cooperative online classroom activities, such as those found at the website of the National Council of Teachers of Mathematics (<http://www.nctm.org>).
- 2) Upload graphs to computers for use in creating project presentations, using free TI Connect software.
- 3) Prepare reports and presentations for group and individual projects.
- 4) Research and review important concepts.

## Technology Acquisitions

<b>Product</b>	<b>Specifications</b>	<b>Qty.</b>	<b>Price each</b>	<b>Total Price includes taxes and shipping</b>
<b>Navigator- TI-84PLUS E-Z Spot Deluxe Class Bundle*</b>	30- TI84PLUS E-Z Spot Yellow Calculators marked with School Property * 1 TI-Presenter & TI84PLUS Silver Edition Viewscreen Calculator * 1 Epson 61P LCD Projector 2000 ANSI Lumens * 1 30HPH Hard Case that holds 30 TI84PLUS Series Calculators.	1 supports 30 students and one teacher.	\$8,760.05	\$8,760.05
<b>30 Pack of TI Keyboards*</b>	Full-Size Keyboard for Touch Typing on TI-84PLUS calculator includes: batteries, non-skid feet, cradle, NoteFolio Creator Software, & Guidebook. * This will allow you to: Access notes by downloading files, edit complete and print assignments with a computer, & use word processing capabilities on a TI handheld. Includes 30 USB cables	1-30 pack	\$1,100.00	\$1,100.00
<b>Cradle*</b>	* Cradle for TI84PLUS Series not included but available from TI at no charge. Call 800-TI-cares	30		Free

\* Photo of item follows

<b>Product</b>	<b>Specifications</b>	<b>Qty.</b>	<b>Price each</b>	<b>Total Price includes taxes and shipping</b>
<b>Windows PC*</b>	eMachines Desktop PC and Monitor (T3042) <ul style="list-style-type: none"> <li>• 17" flat CRT monitor</li> <li>• 256MB DDR SDRAM</li> <li>• CD-RW drive</li> <li>• 40GB hard drive</li> <li>• Stereo speakers</li> <li>NIC network card</li> <li>Keyboard, mouse and surge protector</li> </ul>	11	\$438.73 after \$100 rebate each	\$4,826.03
<b>Printer *</b>	HP Officejet Printer/ Scanner/ Copier <ul style="list-style-type: none"> <li>• Print &amp; Copy 17 ppm</li> <li>• Up to 1200 x 1200 dpi</li> <li>• 36-bit flatbed scanner</li> <li>• Color faxing</li> <li>• Document feeder</li> </ul>	1	\$142.50	\$142.50
<b>Hub*</b>	Superstack II Hub 100TX 12-Port		\$20.00	\$20.00
<b>Cabling for internet access</b>	T-3 Ethernet cable	12 various length cables		\$150.00
<b>Software</b>	Open Office for word processing, spreadsheets and presentations to use on desktop computers	11 copies	Free	
<b>Total Price: \$14,998.58</b>				

Source of prices: <http://www.dandh.com/buycalcs/default.htm>; <http://www.circuitcity.com/>, <http://www.pricegrabber.com/>

\* Photo of item follows



**Navigator-TI84PLUS EZ-Spot Class Bundle**



**Keyboard and Cradle**



**eMachines Desktop PC and Monitor (T3042)**



**HP Officejet Printer/Scanner/Copier**



**CyberPower Surge Protector**

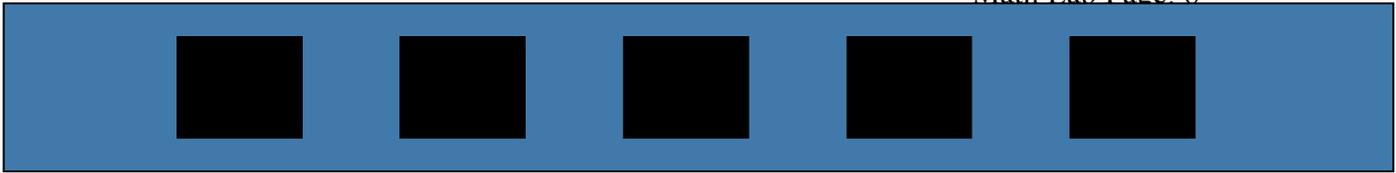


**Superstack II Hub 100TX 12-Port**

## **Floor Plan**

The teacher is enthusiastic, encourages peer learning, and will arrange the space to encourage student interaction. The students will be seated at large round tables that have space for graphing on paper as well as for using a calculator. The computers will be set up will allow them to be shared by three or four students. The work areas will be arranged so that students can see the projection system from each of them. The teacher will have a desk in the back of the room from which she will easily be able to get to all of the students and assist with their work when needed. The desk itself holds the TI Presenter and the teacher's computer.

The lab will be equipped with locally networked graphing calculators available for 30 students and a teacher. The calculators support direct communications between students and the teacher. The calculators will also be tied to a projection system that allows for every student with a calculator to share with the class. Shared computers connected to the Internet and printer/scanner will be available. Computers, relevant software (such as TI Connect graphing software), internet browsers, email for idea sharing, and web-based and e-learning applications will be used to enrich the classroom environment. Graphing calculators, as well as the TI Navigator system designed for them, will assist students in class exercises, assignments, and special projects.



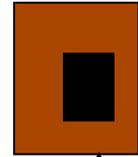
Computers

Group Workstations

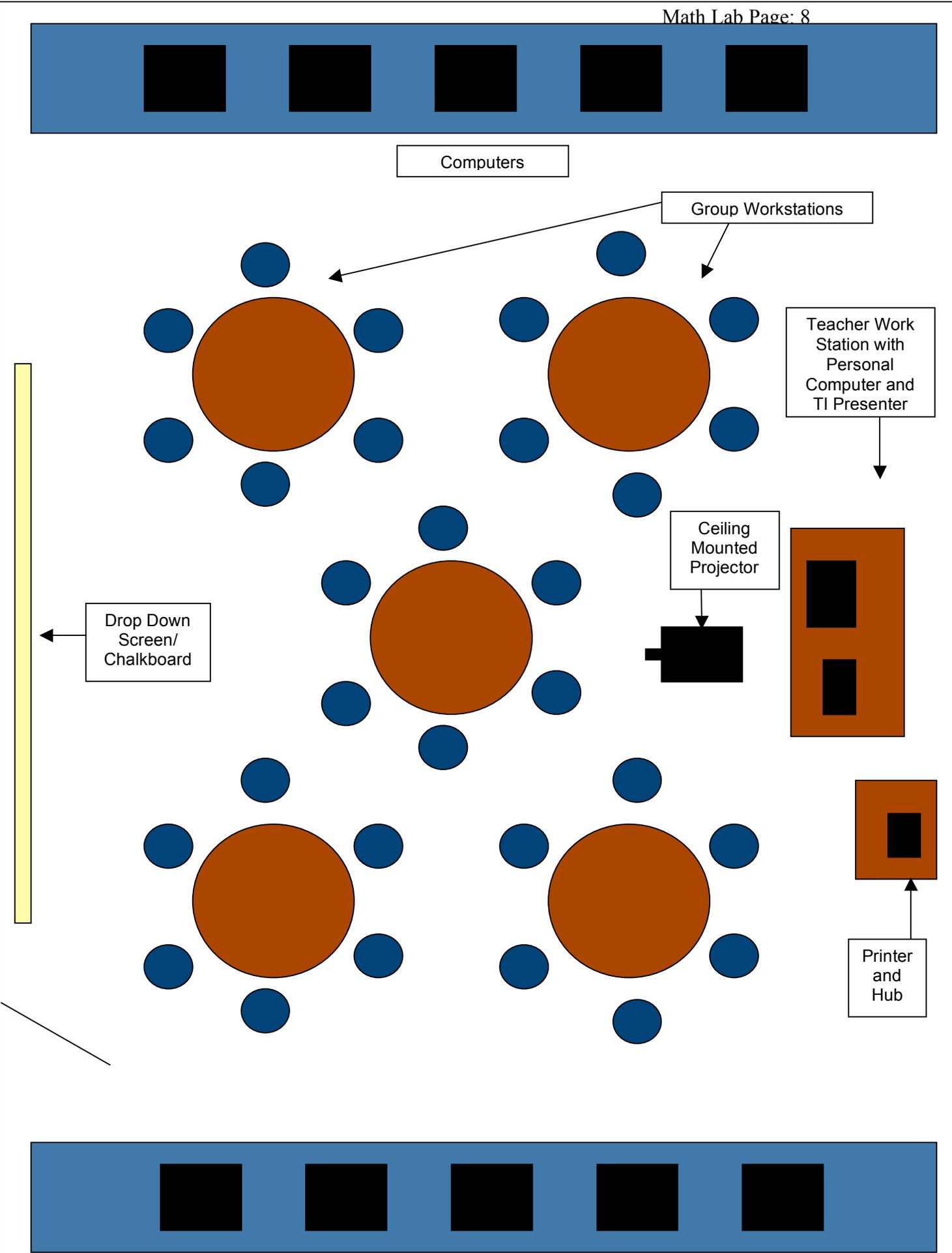
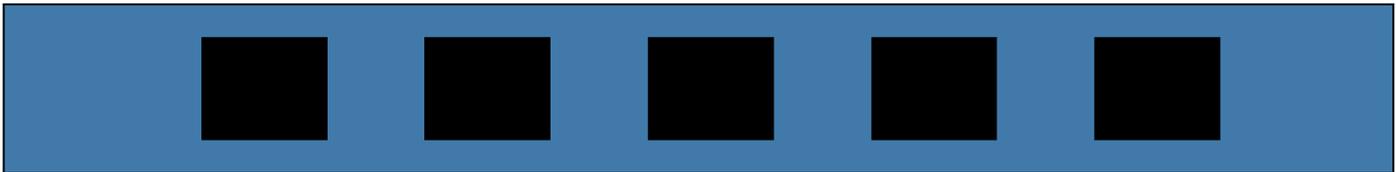
Teacher Work Station with Personal Computer and TI Presenter

Ceiling Mounted Projector

Drop Down Screen/ Chalkboard



Printer and Hub



## Evaluation Plan

The technology additions to school math lab will be assessed to measure their success. This assessment will be performed in several ways. Since this technology plan has placed an emphasis on increased conceptual understanding of mathematics, student achievement is a large part of measuring its success. The Navigator technology has built in assessment capability; quizzes can be administered, and the data is instantly available to analyze. It also provides a mechanism for quick, informal assessment. Navigator allows teachers to poll students on their understanding of a given concept. The teacher can then correct any misunderstanding of concepts students might have.

Since both the Navigator and e-learning activities are to be used to bolster more traditional classroom activities, it should be noted whether student understanding of mathematics is enriched. The grades and test scores of students who took math before the technological enhancement will also be compared with the students who took the math classes after the enhancement. In addition, before implementing the technology, the students will be given a skills survey that examines their abilities to visualize and understand complex mathematical concepts. Each class who uses the lab will have a customized test. Then same survey will be given to the same students after the lab has been in use for 1 semester, and 2 semesters to see if the students' skills have progressed.

Student input on the system is also quite important. A questionnaire and log will be designed to gauge the students' interest and enjoyment of the new technology. Since intrinsic motivation is pivotal to learning, their opinions of both the Navigator and computers are extremely valuable. A questionnaire will gather input on how to improve the use of such technology. Students will also be encouraged to use their observation logs from their math classes to journal about their experiences before and after the lab was implemented.

The teachers will also be surveyed to see how teaching has changed for them. Do they see this lab as a tool that has made teaching more efficient, or more effective? Do they make use of the various components? They will be asked to reflect on their confidence using the new equipment, and asked to provide examples of how it is used and it has improved teaching.