Abstract:

The purpose of this proposal is to gain immediate installation of Epson PowerLite 82c LCD projectors in five middle school mathematics classrooms, ranging from grade six to grade eight. In keeping up to date with the demand for technologically integrated classrooms, Quincy Middle School (QMS) has already brought desktop computers to every classroom for teachers’ use. LCD projectors will further advance the incorporation of technology by allowing the teachers to share information with their students on a much larger scale than gathering around the computer monitor. The implementation of LCD projectors in mathematics classrooms will meet four main objectives:

1. Provide all learners with the opportunity to meet or exceed Grade Level Content Expectations (GLCEs) and National Council of Teachers of Mathematics (NCTM) Principles and Standards by enhancing teaching methodologies, making lessons meaningful to each student.
2. Integrate technology into the classrooms on a daily basis.
3. Increase learning time, enabling students to reach mastery level mathematics.
4. Connect mathematics curriculum to other subjects and real-world applications.

The immediate installation of LCD projectors will assist in making Quincy Middle School a technology leader. Curriculum will be enhanced by allowing teachers to provide Internet-based instruction to the students without relocating to the computer lab. LCD projectors will provide mathematics teachers with the necessary means to teach meaningful, interactive lessons to students within the classroom.

Assessment of Need:

According to the Chicago based firm Leonard Consulting, 65% of the population learns visually (Retrieved July 24, 2006). However, most classroom teaching is directed toward the auditory learners. As Bell and Garofalo found in their research, projectors allow a teacher’s only classroom computer to become a teaching tool that he/she can share with the students (2005). The QMS middle school computer lab is currently equipped with 29 student accessible computers. In the 2005-06 school year, there were 309 students attending Quincy Middle School. This means, during one class period, less than 10% of the middle school students have direct access to a computer. The media center also has an independent computer lab which may be used by any middle or high school student. Although teachers do sometimes utilize the independent lab for instruction, there is no guarantee enough computers will be available. It is also very easy for students and teachers to become distracted while working in the independent lab. Bell and Garofalo’s research also identified the benefit of having all students focusing on the same instructional tool, rather than each student working on his/her own computer at a different pace. By equipping mathematics classrooms with LCD projectors math teachers can introduce concepts to all the students at the same time. As a result, the computer labs will be more available to language arts classes, allowing those students to do independent
research and type reports. As teachers deal with pressure to provide meaningful instruction to all types of learners, they must differentiate from the traditional teacher-lecture method. During one lesson with the LCD projectors, a QMS math teacher may introduce a concept verbally reaching auditory learners, show a United Streaming video for the visual learners, and then assign a project for the kinesthetic/tactile learners. Another lesson would include students solving for area or radius of circles on the board and using Cabri Geometry to further explore the relationship between the area and radius. Once students explore with Cabri Geometry, they will explain their findings to classmates. LCD projectors will allow the students to provide visual aids during the presentations. All learning styles are encompassed in both aforementioned lessons. Quincy Schools currently have licensing for both United Streaming and Cabri Geometry. United Streaming is “is proven to increase student achievement -- and helps schools meet the requirements of No Child Left Behind” and is directly linked to state and national standards (Discovery Education). Without the LCD projector students would be required to hover around a single 18 inch computer monitor. Research supports that information is better retained if viewed on a large scale. LCD projectors, along with technology QMS already has, will allow teachers to use mathematics software and websites as catalysts for mathematics education. These tools will support higher level mathematics learning to occur. Michigan’s grades 6 to 8 GLCEs adhere to an algebra curriculum. Due to the demanding curriculum little time is allotted throughout the school year to review previously learned concepts. Teachers must utilize technology to move forward quickly, yet ensure students are mastering the concepts. LCD projectors will also simplify and improve cross curricular learning and real-world application. For nominal fees teachers may subscribe to websites such as www.brainPOP.com. Several of the middle school GLCEs require practice with linear equations; solving, manipulating and graphing. Videos relating to linear equations, plus hundreds of other connections can be found at brainPOP.com. According to Mark Prensky, in his article “Engage Me or Enrage Me”, children are highly capable of learning complex material easily if they are interested. Incorporating technology into daily lesson plans will engage the students because technology use is instinctive to their habits. By projecting mathematical concepts onto a large screen with creative presentation formats lessons will better suit students’ learning styles.

Proposed Project:

Immediate installation of Epson PowerLite 82c LCD projectors in all middle school mathematics classrooms will allocate daily use of technology in the classroom. LCD projectors will be used to enhance current technology already provided by the school district. These technologies include classroom computers, including all existing hardware and software, TI-83 graphing calculators, United Streaming videos, and Classroom Performance Systems (CPS). Having the LCD projectors in place will make available opportunities for new technology in the future. Possible forthcoming technologies that will encourage meaningful mathematical learning include whiteboards, district subscriptions to more math related websites, and Texas Instrument software to capture information from graphing calculators, such as graphing emulators for TI-83 graphing calculators. Projecting images will support deeper understanding of mathematical
concepts allowing students to becoming problem solvers. Images portrayed with LCD projectors will provide opportunity for all students in a classroom to observe mathematical context first hand, rather than requiring teachers to expecting them to imagine it. Clearly provided data will afford more time for critical thinking and more concrete understanding.

**Goals, Objectives, Outcomes:**

Through the views of images produced with an LCD projector, QMS mathematics teachers will provide engaging lessons to the students. The students will have the opportunity to put meaning to mathematical concepts they previously were required to simply picture in their minds. Projections will give each student the same imaging as each of his/her classmates, as well as that of the teacher. LCD projectors will allow students to see concepts concretely on a daily basis, which in turn will allow students to attain mastery level understanding and real-world application. These lessons will be offered in the classroom without having to reassemble the class in a computer lab.

Objective 1. Provide all learners with the opportunity to meet or exceed Grade Level Content Expectations (GLCEs) and NCTM Principles and Standards by enhancing teaching methodologies, making lessons meaningful to each student.

A. [www.brainPOP.com](http://www.brainPOP.com)
   a. This site has 361 videos directly link to Michigan’s grade 6 – 8 GLCEs.
   b. There is a nominal fee for this website, but free 14-day trials are available as well as some permanently free tutorials.

   a. This site links directly to the NCTM Principles and Standards. Activities are appropriate for learning middle school mathematics.
   b. Concepts focus on…
      i. Number and Operation
      ii. Geometry and Measurement
      iii. Function and Algebra
      iv. Probability and Data Analysis

C. [www.figurethis.org](http://www.figurethis.org)
   a. This site offers math challenge ideas the students can physically do.
   b. The teacher can resource this website to introduce projects.

Objective 2. Integrate technology into the classrooms on a daily basis.

A. LCD projectors in middle school mathematics classrooms will allow teachers to utilize currently accessible technology for entire lessons or brief applets into lessons in the classroom rather than relocating to the computer lab.

B. The purchase and installation of LCD projectors and supplementary hardware will provide the benefits of additional computer labs without the additional cost of building and supplying new media centers.

C. Personalized and meaningful student learning will more likely to occur due to immediate access to mathematics software and the unlimited resources.
LCD Projectors in Middle School Mathematics Classrooms

Pam Losinski: Middle School Mathematics

available on the Internet. These instructional tools will allow students to visualize mathematical concepts.

D. In Jere Brophy’s research article, argument eight suggests “that activities and assignments should be sufficiently varied and interesting to motivate student engagement” (Teaching: Educational Practices Series-1, p 23). Technology will assist teachers to teach to all learning styles.

Objective 3. Increase learning time, enabling students to reach mastery level mathematics.

A. Combined use of the teacher’s computer and an LCD projector will allow students to learn mathematical content regardless of their computer abilities.

B. Students benefit from use of the LCD projector and other technology as…

a. An object to learn how to use technology.
   i. Students will learn use software, such as Cabri Geometry.
   ii. Students will learn to operate hardware, such as Classroom Performance System (CPS).

b. A medium to learn with technology.
   i. Using applets to manipulate proofs.
   ii. Using websites and videos to gain further clarification or alternative forms of explanation of mathematical concepts.

c. A catalyst to speed learning with the use of technology.
   i. Using software to transform linear equations from data tables to lines on a coordinate plane.
   ii. Most people in today’s society speak technology fluently. Students easily learn concepts from computer programs they struggle to master with pen and paper. Technology is part of their nature.

Objective 4. Connect mathematics curriculum to other subjects and real-world applications.

A. Middle school math and science curriculums include extensive work with the metric system.
   a. The website www.mathforum.com includes conversion tools students can use to check their work.
   b. Teachers could access resource sites, such as http://dmoz.org/Science/Reference/Units_of_Measurement/ to provide definitions, rules and conversions to the students. Oral interpretation as well as projecting the site onto the screen would meet the needs of both auditory and visual learners.
   c. Conversion between units within the Metric System directly satisfies a state of Michigan’s 6th grade GLCE; M.UN.06.01 Convert between basic units of measurement within a single measurement system, e.g. square inches to square feet.

B. Use of the diagram tool in Microsoft Word or websites such as Create A Graph to interpret information.
   a. Teachers will create graphs to organize data from scientific experiments.
LCD Projectors in Middle School Mathematics Classrooms

Pam Losinski: Middle School Mathematics

i. Large screen projections will provide visual aids for explanation.
ii. Large visual aids provide opportunity for all students to view detailed graphs.
iii. Utilizing the zoom option will provide teachers and students the necessary means for defining parts of the graphs.
b. Students will create graphs to organize data from scientific experiments.
   i. Students will brainstorm to initiate discussion of the meaning of graphs.
   ii. They will make hypotheses from data provided.
C. Students will make real-world connections.
   a. During Math 8 end of year presentations, the students will design lessons using Microsoft PowerPoint.
      i. PowerPoint applications will be used in future school years and careers.
      ii. PowerPoint presentations will allow students to effectively teach context rather than focusing on memorizing the material they want to teach.
   b. United Streaming videos will introduce students to many mathematics career opportunities.

Expected outcomes are as follows:

A. Higher test scores.
   a. MEAP
   b. NWEA (Northwest Evaluation Association)

B. Students attain mastery learning levels.
   a. Coverage of all middle school mathematics GLCEs and NCTM Principles and Standards.
   b. Teachers will use technology as a catalyst to provide more deeply meaningful instruction to students.
   c. Through Internet-based instruction students will make connections between mathematics curriculum and real-world application.

C. Teach to Multiple Intelligences.
   a. Visual
      i. Teacher projects images from computer to large screen for students to see.
      ii. All students are able to see real examples rather than envisioning material in their minds.
   b. Auditory
      i. Use video/audio to provide alternative explanation of math concepts.
      ii. Speakers attached to the computer will allow students to listen to explanation as videos are shown. If there are questions, teachers may rewind video and clarifications may be made in real time.
   c. Kinesthetic/Tactile
LCD Projectors in Middle School Mathematics Classrooms

_Pam Losinski: Middle School Mathematics_

i. Students will have countless opportunities to operate technology hardware (computer and LCD projector) in the classroom.

ii. Software provided by the teacher and school district will permit students to manipulate problems and proofs to develop deeper understanding.

**Plan of Operation**

LCD projectors in middle school mathematics classrooms will incorporate technology into the classroom on a daily basis. Specific activities that will utilize the classroom computer and LCD projector directly include:

**A. Math 8 end of year projects.** Students work in groups of 3 – 4 students to revisit six major topics covered throughout the school year. (Included below are the 8th grade Michigan GLCEs each topic covers.)

_a. Volume and Surface Area_  
_i. G.SR.08.06 Know the volume formulas for generalized cylinders (area of base) · height), generalized cones and pyramids (\( \frac{1}{3} \) (area of base) · height), and spheres (\( \frac{4}{3} \pi \) (radius)\(^3\)) and apply them to solve problems._  

_i. G.SR.08.07 Understand the concept of surface area and find the surface area of prisms, cones, and spheres._

_b. Area and Perimeter_  
_i. G.SR.08.03 Understand the definition of a circle; know and use the formulas for circumference and area of a circle to solve problems._  

_i. G.SR.08.04 Find area and perimeter of complex figures by subdividing them into basic shapes (quadrilaterals, triangles, circles)._  

_i. G.SR.08.05 Solve applied problems involving areas of triangles, quadrilaterals, and circles._

_c. Pythagorean Theorem_  
_i. G.GS.08.01 Understand at least one proof of the Pythagorean Theorem; use the Pythagorean Theorem and its converse to solve applied problems including perimeter, area, and volume problems._  

_i. G.LO.08.02 Find the distance between two points on the coordinate plane using the distance formula; recognize the distance formula is an application of the Pythagorean Theorem._

_d. Graphing_  
_i. A.RP.08.06 Graph factorable quadratic functions, finding where the graph intersects the x-axis and the coordinates of the vertex; use words “parabolas” and “roots”; include functions in vertex form and those with leading coefficient -1, e.g. y=x\(^2\)-36, y=(x-2)\(^2\)-9; y=−x\(^2\); y=−(x-3)\(^2\)._  

_i. A.RP.08.04 Use the vertical line test to determine if a graph represents a function in one variable._
LCD Projectors in Middle School Mathematics Classrooms

Pam Losinski: Middle School Mathematics

iii. Solve simultaneous linear equations in two variables, by graphing, by substitution, and by linear combination; estimate solutions using graphs; include examples with no solutions and infinitely many solutions.

e. Proportions/Similar Figures
i. G.TR.08.09 Understand the definition of a dilation from a point in the plane and relate it to the definition of similar polygons.
ii. N.FL.07.05 Solve proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation $a/b = c/d$.

f. Problem Solving
i. Although problem solving doesn’t directly link to the Michigan 8th grade GLCEs, it is imperative for middle school aged children to become good problem solvers. They must be able to think critically, question reasonableness of solutions, and make educated hypotheses.

B. Viewing videos from United Streaming and other outside sources.
C. Accessing websites to provide visual aids for more meaningful interpretation of mathematical concepts.
D. Utilize CPS system to evaluate overall class performance and individual student progress.
E. Employ existing technology and the classroom LCD projector to bring technology to students as an object, a medium, and a catalyst.

Implementation Timeline

This proposal will be presented to building administration and IT support in September 2006. Assuming approval by administration, products will be ordered in October 2006. Most Epson PowerLite 82c LCD projectors are available for shipping within 7 – 10 business days from merchants listed below in the budgeting proposal. Delivery via UPS Ground Shipping may take up to 5 business days. Once products are ordered they should arrive at Quincy Middle School within 3 weeks. Installation should occur during winter break, which is scheduled for December 21, 2006 to January 2, 2007. Installation will be completed by the IT Director and QMS maintenance staff. Each QMS middle school mathematics classrooms should be ready for LCD projector use on January 3, 2007.

Program Personnel

The responsibility of maximizing use of the LCD projector would lie primarily on the classroom mathematics teachers. They would be accountable to make sure technology was being utilized on a daily basis to increase learning. The school administrators and IT support would be responsible for providing support to the teachers via professional development training, tutorials, and technical support. The middle school media specialist would also be available to provide technical support.
Budget

QMS middle school science classrooms are currently equipped with Epson PowerLite 811p LCD projectors. These projectors are no longer being manufactured. It has been determined the Epson PowerLite 82c LCD projector is compatible to the Epson PowerLite 811p LCD projectors both in cost and functionality.

A. Epson PowerLite 82c LCD Projector

<table>
<thead>
<tr>
<th>Merchant</th>
<th>Unit Cost</th>
<th>Shipping &amp; Tax per Unit</th>
<th>Subtotal Per Unit</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Photo</td>
<td>$1,098</td>
<td>$63</td>
<td>$1,161</td>
<td>5</td>
<td>$5,805</td>
</tr>
<tr>
<td>Prestige Camera</td>
<td>$1,102</td>
<td>$52</td>
<td>$1,154</td>
<td>5</td>
<td>$5,770</td>
</tr>
<tr>
<td>Broadway Photo</td>
<td>$1,119</td>
<td>$47.56</td>
<td>$1,166.56</td>
<td>5</td>
<td>$5,832.80</td>
</tr>
<tr>
<td>Digital Liquidators</td>
<td>$1,130</td>
<td>$81.15</td>
<td>$1,211.15</td>
<td>5</td>
<td>$6,055.75</td>
</tr>
</tbody>
</table>


B. Universal Ceiling Mount
   a. RPA universal mount
   b. 4.93 lbs.
   c. $139 plus shipping & tax per unit
   d. Total cost for 5 units: $842.70

C. Epson PowerLite 82c Multimedia Projector Replacement Bulb
   a. 200 watt UHAE replacement lamp
   b. $299 plus shipping & tax
   c. Total cost for 5 units: $1,849.70

D. Composite 25’ Video Cable
   a. High resolution cable wrapped in X-traflux jacket
   b. $16 plus shipping & tax
   c. Total cost for 5 units: $137.80

E. S-Video 25’ Cable
   a. High resolution coax conductors for the highest quality image reproduction
   b. $33 plus shipping & tax
   c. Total cost for 5 units: $227.90

F. CGA-25’ Cable
   a. SuperFlex VGA MHR Cable
   b. $62 plus shipping & tax
   c. Total cost for 5 units: $381.60

Total proposed cost of hardware needed for installation of five classroom LCD projectors and accessories: $9,209.70

Based on 2005 – 06 QMS population of 309, and the assumption that each student takes a mathematics class every year the annual cost per student is $29.80. Epson suggests their LCD projectors operate maintenance free for at least five years, with initial maintenance including bulb replacement. If the cost is distributed over those first five years, cost per student is less than $6 per year.

Possible Pitfalls

Once approval is gained for order of the Epson PowerLite 82c LCD projectors for five middle school mathematics classrooms some possible consequences may be faced:

1. Business Manager turn around time to process and send Purchase Order may take longer than the one month turn around time anticipated.
2. If order time is delayed, shipping may occur during holiday months causing postponement due to increase package volume within designated delivery companies.
3. Merchants may not have each product in stock and ready for shipment as order is placed.
4. IT Support and maintenance staff may have conflicting schedules during winter break not allowing for all LCD projectors and other necessary hardware to be installed in a timely fashion.
5. Due to the age of the building QMS resides in, any number of problems may arise during installation period. Difficulties with building structure providing adequate support for hardware will have to be dealt with as they develop.

Resources Utilized:

http://www.leonardconsulting.com/visual_aids.htm

Bell, Randy L. and Garofalo, Joe, January 2005, School Science and Mathematics
http://www.findarticles.com/p/articles/mi_qa3667/is_200501/ai_n9467818

http://www.learning-styles-online.com

Discovery Education, Retrieved July 26, 2006
http://www.unitedstreaming.com/home/benefits.cfm?id=1&subid=103

Evaluation:

Prior to proposal presentation to building administration, each student will complete a learning style inventory from http://www.learning-styles-online.com. This 70 question test will help teachers, administrators and students understand each student’s learning needs. Evaluation of these inventories will support the need for the LCD projectors for visual learning and technology implementation.

Several factors will be evaluated to determine how implementation of LCD projectors in classrooms improve student learning once installation has occurred. Current year chapter
quizzes and test scores will be cross-examined with previous years’ scores to assess depth of learning. End of year exams will also be cross-examined. A three percentage point increase in overall class averages should be attained over a two year period comparing end of year grades from 2006 to 2008. Since implementation will take place mid-school year 2006 – 07, these results should not be assessed until end of the following school year. However, a small increase (less than 3%) should occur after the 2006 – 07 school year. Mathematics MEAP scores will be looked at to determine students’ progress toward mastery learning. A 2% increase from 2006 – 07 results to 2007 – 08 should occur. Again, a slight increase (less than 2%) should occur from 2005 – 06 to 2006 – 07 school year. Seventy-six percent of QMS 8th grade students met or exceeded MEAP requirements in Fall 2005. End of year presentation evaluations for Math 8 students will provide feedback as teachers compare previous students’ presentations to current. When evaluating these presentations teachers should consider students’ confidence and depth of explanation and understanding. Eighth grade teachers will reflect to previous years’ presentations as well as GLCE outcomes to assess growth. On going teacher evaluation will be done using the Classroom Performance System.

**Timeline for Evaluation:**

A. End of year grades should be cross-examined as soon as they are posted or before June 15 of each school year. This evaluation will be done annually.
B. MEAP score evaluations will be completed in March of each year, following October testing.
C. Teachers will compare Math 8 presentations during summer break(s). Reports should be discussed between both Math 8 teachers and then a final summary should be provided to the building principal prior to the start of the following school year.

**What I have learned:**

Constructing this proposal taught me the importance of making strong arguments for bringing technology hardware to mathematics classrooms. I have always known there is a great opportunity to implement technology into mathematics curriculum, but writing this proposal allowed me to share my thoughts with people who may not see the importance of implementation. By researching articles and Internet-sites to support my reasoning my arguments are much more convincing and concrete. Initially, determining the budget concerned me regarding project implementation. After “crunching the numbers” I realized it was very realistic if the cost was associated per student over a five year span.