

# **Technology in Education: Website Development and Student Response Systems**

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## **Introduction**

Computer classes were first offered at Terre Haute South Vigo High School in 1981 (my senior year in high school). Those classes were in programming, not applications, and were taught by teachers in the mathematics department. Possessing a computer science teaching minor along with my mathematics major has always seemed to benefit me. Beginning in 1994, I taught computers for nine years, until the state of Indiana decided computer classes could only be taught by business teachers. At that time, I went back to teaching mathematics. However, my passion for working with technology and trying to bring technology into my teaching using PowerPoint persists. But while PowerPoint presentations can be colorful and provide animation, my students just prefer me at the chalkboard with a piece of chalk. What is a teacher who loves technology to do?

## **Professional Development**

In the summers of 2004 through 2007, the Indiana Mathematics Initiative (IMI) sponsored two-week workshops on mathematical modeling. The sessions were held at Indiana University (IU) and taught by mathematics department professors who were working with the IU-IMI Mathematics and Science Partnership grant. As a component of the grant, secondary teachers were to be involved in professional development centered on real-life problem solving. High school and middle school mathematics teachers in the nine districts participating in the MSP grant were invited to the workshop. I was one of two teachers from Vigo County who took part in summer 2004. Subsequently ten teachers from Vigo participated in summer 2006.

The workshops focused on learning about and then constructing mathematical models that we could integrate into our high school mathematics classes. As a group, we continued to meet in weekend sessions over the following school year to refine our ideas and share our successes and challenges with fellow teachers.

Returning to Terre Haute South Vigo High School and my Algebra I students in the fall, I attempted to use mathematics models as an introduction to new material. In developing models, I was repeatedly reminded that models, not applications, were to be created. My frustration arose due to my lack of success. However, at the summer workshop I had become involved with teachers from other districts in discussions of successful tools and methods being used in the different school districts' mathematics classrooms. Through these conversations, I learned about teachers using technology, such as *e-Instruction's* Classroom Performance Systems (CPS) and Quia, in instruction. So, when I created my first web page using Quia for Advanced Placement (AP) Statistics, I attached the files with my mathematics models to the web site for my students.

In addition, instead of using my pencil and paper reviews and quizzes for the units that I had mathematics models for, I used CPS. Eventually, my mathematics models took a back seat to my working with Quia and CPS, because I was successful at using the technology.

After the summer of 2005, IMI continued working with the high school teachers involved with modeling. However, they showed us other ways to improve student performance in the classroom besides modeling. I believe IMI obtained the ideas from surveys that teachers filled out at meetings and conferences, asking us what we would like to know more about that brings success in the classroom. Well, that peaked my interest! I went to conferences and meetings with many speakers about education, standards, textbook adoption, and successful programs in the classroom. I enjoyed learning about playing games and using activities in the classroom to stimulate motivation and learning by Carolyn Bronson and Heather Hart. Once again, at these meetings, I met other teachers who were using games and technology with success, increasing motivation and test scores for their students. While I could never develop the games that Carolyn and Heather have created, I could use what they taught me. I could develop reviews that I could use with CPS and share electronic games with teachers on my website. Sadly, the original IMI grant ended in the summer of 2008. As a teacher, I will miss sharing with fellow teachers from all over the state the new information and ideas the staff at IU and IMI provided us, with a focus on how to better educate our students.

### **Using Technology in Mathematics Education**

The Indiana Academic Standards for Algebra states, “*Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students’ learning.*” Furthermore, the standards discuss how a student can learn higher levels of mathematics with the correct use of technology.<sup>1</sup> The National Council for Teachers of Mathematics (NCTM) and most state standards require teachers to use technology when instructing their students. The NCTM’s *Principles and Standards for School Mathematics* envisions every student having access to and using technology in his or her mathematics education. Furthermore, the NCTM recommends a student use technology to understand and perform translations, solve equations, inequalities, and systems of equations, and judge the meaning and reasonableness of the answers resulting from symbol manipulations. In addition, technology and the use of computers have helped students with different learning styles and abilities in their education.<sup>2</sup>

It seems insufficient to just use the textbook, supplemental worksheets, and calculators for materials, since students have been using these items since elementary school. In this age of technology, education needs to find ways to educate and entertain the students, as we are competing with gaming systems for their time and attention. I teach in a large school with very few computer labs available to use as instructional tools, so teaching students individually on computers during class time is not an option. However, I can provide my students with this opportunity outside of school, if they desire to take advantage of it. It is my desire to give students as many opportunities as possible to be successful in my class and to help prepare them for any future endeavors they might encounter using mathematics and/or technology.

### **Using Technology in My School**

Vigo County School Corporation has the highest poverty rate for children in the State of Indiana. My school is a four-year high school with a population of 1700+ students, of whom 34% were eligible for free or reduced lunch in the 2007–2008 school year. In addition, we have several

two-year and four-year colleges in our county. This means that we have children of college students from all over the world, and therefore our English as a Second Language (ESL) population is increasing as well. Furthermore, our special needs population keeps growing every year. Special needs students accounted for approximately 19% of the student population of my school in 2006. Often, special needs and ESL students are mainstreamed into my classroom. I needed to find a way to motivate students who come from poverty and/or have learning problems including language barriers. I found possible solutions to my dilemma with Quia and CPS.

### **Using Quia in My School**

I was sold on the concept of Quia by another teacher in our high school. She was trying to get enough teachers together who would like Quia accounts to convince our corporation to buy subscriptions for us based on the educational benefits to our students. It worked — I have had my Quia subscription paid for by my corporation for three years now. Where did my corporation come up with the money in these days of tightened budgets? The school corporation received a grant from the federal government for Smaller Learning Communities. Quia subscriptions are \$49.00 per instructor and this includes access for all of the instructor's students. Of course, if ten or more teachers from one corporation subscribe, then the price gets cheaper. You can email [orders@quia.com](mailto:orders@quia.com) for more information on subscription costs.

### **Advantages of Using Quia**

You may be wondering, “How does this help my students?” or “That will never work for me because all of my students do not own a computer!” Well, different teachers use their web sites with different goals in mind. For example, I know my students do not all own home computers. While it is true that students can go to the public library or the school library to use computers, I do not want to put a burden on parents who may have evening jobs and cannot take their children to the library. So, basically I use my web site for students to obtain additional instruction and enrichment activities. Furthermore, any student with Internet access can use my web sites to assist them in their studies any time they desire providing them with a modern, entertaining, and different way to review or provide reinforcement of their mathematics skills.

In the spring of 2009, a Core 40 Algebra I end-of-course test will replace Indiana's present Graduation Qualifying Exam. Passing the Algebra I test will become a requirement for graduation. I have developed a practice Core 40 test posted on both of my Algebra websites that have two hundred questions and answers in Word format. Anyone can download this and practice for the Core 40 test or my final exam.

My students have told me that the website helped them when they were absent. In addition, I know some of them looked at the Core 40 test on-line to help them study for their final exam. Next year, I plan to conduct a survey at the end of the school year on classes to find out their opinion of the website and its usefulness. However, I do know that during one trimester, there were nearly three hundred hits on the website, so it is definitely being used.

### **What is Quia?**

So, what exactly is Quia (pronounced *key-ah* and rhymes with *Maria*), which is short for *Quintessential Instructional Archive*? Quia is a tool that teachers can use to create seventeen different types of games and learning activities on-line for their students to learn, practice, and review concepts. These include:

- Concentration
- Battleship
- Challenge Board
- Cloze
- Hangman
- Jumbled Words
- Patterns
- Picture Perfect
- Rags to Riches
- Scavenger Hunt
- Matching
- Mini Quiz
- Flashcards
- Word Search
- Pop-ups
- Ordered List
- Columns

In addition, teachers can create ten types of questions for on-line quizzes and tests including:

- Multiple Choice
- True/False
- Pop-up
- Multiple Correct
- Fill-In
- Initial Answer
- Short Answer
- Essay
- Matching
- Ordering

Besides these features, Quia also offers an opportunity to share the teacher's activities with anyone in the world who has Internet, copy and modify any activity to suit the teacher's needs, upload images, files, and audio clips, maintain an online calendar, create class pages for communicating with students, create surveys with all the statistics work taken care of, and create classes (as in a gradebook) that can track students' results.

### **Development of Quia**

Paul Mishkin founded Quia in March 1998, after developing and refining the concept for several years. The reason Mishkin developed this web-based technology was to improve education. He wanted to make teachers' jobs easier by saving them time, while motivating and engaging students and assisting them to learn faster.

## Quia Resources

I have created individual websites for my students enrolled in Algebra One ([www.quia.com/pages/davies4.html](http://www.quia.com/pages/davies4.html)), Algebra Two ([www.quia.com/pages/davies3.html](http://www.quia.com/pages/davies3.html)), and Advanced Placement Statistics ([www.quia.com/pages/davies2.html](http://www.quia.com/pages/davies2.html)). These websites contain:

- games that other Quia users have created and shared
- files that contain crossword puzzles and quizzes that I created and uploaded
- a practice Core 40 test that I created
- other websites students can go to for additional help
- my email address
- their textbook website
- the current week's schedule for each class

In addition, I created handouts for teaching the South Vigo staff about Quia and how to code mathematics symbols (See <http://www.quia.com/latex.html> or <http://www.maths.tcd.ie/~dwilkins/LaTeXPrimer/> for coding information) for making games and/or activities. This is similar to simple programming but can be overwhelming for the teacher who is not computer savvy. In the in-services that I have presented, it is amazing how the teachers got excited and involved in creating websites and using all the different resources that Quia has to offer in website development. Teachers are always eager for more opportunities to improve their websites for the benefit of their students.

The information provided is from the Quia website and my knowledge as a subscriber. Further information and answers to questions about Quia can be found either through the Questions and Answers Forum online or in an email to Quia. The website to go to is <http://www.quia.com/faq.html#abq3>.

## Examples of Quia Web Pages



### Quick Log In

You are logged in as **Mrs. Davies**. [log out](#)

Username:

Password:

Go

### New to Quia Web?

What does Quia Web offer?

[Tour Quia Web now.](#)

[Create a new account](#)

[Trouble logging in?](#)

[Subscribe Now!](#)

[Get a FREE 30-day trial](#)

[Forgot your username?](#)

[Forgot your password?](#)

### Instructor Zone

Enter >>

Create activities, quizzes, calendars, surveys, Web pages ...

View grades, quiz results, survey results ...

### Student Zone

Enter >>

Play activities  
Take quizzes  
View results ...

### What's new

- School wide sharing network
- Mass proficiency testing
- Advanced reports and graphs
- Administrator subscription control
- Master student roster uploading
- Our latest newsletter

### Shared Activities

Enter >>

Search  
by keywords  
by category  
by textbook / resource

Copy and customize

[Art](#) [Geography](#) [Mathematics](#)  
[Astronomy](#) [German](#) [Medicine](#)  
[Biology](#) [History](#) [Music](#)  
[Chemistry](#) [Italian](#) [Science](#)  
[English](#) [Japanese](#) [Spanish](#)  
[French](#) [Latin](#) [Technology](#)  
 ...and 100 other subject areas

This is what [www.quia.com](http://www.quia.com) looks like for me as the teacher. Notice my name in the upper left-hand corner of the window. Teachers enter through the Instructor Zone with their usernames and passwords. If a teacher makes classes, then each student will have a username and password for the Student Zone. Remember, a teacher does not have to create classes for students to use the Quia website.<sup>3</sup>

## Instructor Zone

Welcome, Mrs. Thompson

[Comments and suggestions](#)  
[Brochures and presentation materials](#)  
[Quiz Web tutorial](#)  
[Quizzes FAQ](#)

[Classes](#) [Quizzes](#) [Activities](#) [Surveys](#) [Files](#) [Preferences](#) [Help](#)

Create a new

matching, flashcard, concentration, word search

[Import a word list](#)

[Sample activities](#)

[Share your activities with the world](#)

Looking for ideas? [Check out activities others have made!](#)

### My Activities

New folder name:

Title and URL	Type	Hits	Add	Other
[copied activities]	Open Rename Delete			
Basic English	Open Rename Delete			
Foreign Languages	Open Rename Delete			
Physics	Close Rename Delete			<input type="checkbox"/>
<b>A SOUND REVIEW</b> <a href="http://www.quiz.com/bs/52825.html">http://www.quiz.com/bs/52825.html</a>	Edit	12		<input type="checkbox"/>
<b>Amplitude Modulation and Radio</b> <a href="http://www.quiz.com/cj/60796.html">http://www.quiz.com/cj/60796.html</a>	Edit	0		<input type="checkbox"/>
<b>Electromagnetic Spectrum</b> <a href="http://www.quiz.com/d/44198.html">http://www.quiz.com/d/44198.html</a>	Edit	2		<input type="checkbox"/>
<b>Energy - Chapter 10</b> <a href="http://www.quiz.com/jg/672837.html">http://www.quiz.com/jg/672837.html</a>	Edit	0		<input type="checkbox"/>
<b>Famous Physicists</b> <a href="http://www.quiz.com/jg/323353.html">http://www.quiz.com/jg/323353.html</a>	Edit	57		<input type="checkbox"/>
US Geography	Open Rename Delete			
<b>Other Activities</b>				<input type="checkbox"/>
<b>Animal Classifications</b> <a href="http://www.quiz.com/mz/17026.html">http://www.quiz.com/mz/17026.html</a>	Edit	103		<input type="checkbox"/>
<b>Animal Facts</b> <a href="http://www.quiz.com/sh/7580.html">http://www.quiz.com/sh/7580.html</a>	Edit	75		<input type="checkbox"/>
<b>Bill of Rights Battleship</b> <a href="http://www.quiz.com/bs/76620.html">http://www.quiz.com/bs/76620.html</a>	Edit	9		<input type="checkbox"/>
<b>Countries Word Jumble</b> <a href="http://www.quiz.com/jw/130709.html">http://www.quiz.com/jw/130709.html</a>	Edit	2		<input type="checkbox"/>
<b>Geography: Famous Places</b> <a href="http://www.quiz.com/pa/5061.html">http://www.quiz.com/pa/5061.html</a>	Edit	74		<input type="checkbox"/>
<b>Italian animals</b> <a href="http://www.quiz.com/jg/763433.html">http://www.quiz.com/jg/763433.html</a>	Edit	27		<input type="checkbox"/>
<b>Les animaux</b> <a href="http://www.quiz.com/jg/763464.html">http://www.quiz.com/jg/763464.html</a>	Edit	7		<input type="checkbox"/>

This is what the Instructor Zone looks like for copying or creating games and activities.<sup>4</sup>

## Human Anatomy Midterm



This sample quiz demonstrates the various question types and features available in Quiz.

1. Which of the following is NOT a trait shared by all living organisms? (1 points)
  - evolution
  - digestion
  - growth
  - photosynthesis
2. Cells group together to form tissues. (1 points)
  - True
  - False
3. The skin is the body's largest organ. What are the functions of the skin? (Hint: There are multiple correct answers. Choose all that apply.) (3 points)
  - regulates the body temperature
  - excretes some wastes
  - absorbs some chemicals and vitamins
  - sensation

This is an example of a quiz created in Quia on-line.<sup>4</sup>

**World Capitals**  
Learn the capitals of various countries

Directions: Find the matching squares. See a [list of terms](#) used in this activity.

	Caracas	Quatemala City		Matching
Mauritius	Czech Republic		Georgia	
Venezuela			Quatemala	
	Port Louis	Prague	Tbilisi	<input type="button" value="Randomize"/> <input type="button" value="Show answers"/> <input type="button" value="Start over"/>

Caracas

**SAT Vocabulary**  
Guess the vocabulary words. There is a hint to help you.

4 out of 10

HERBIVOROUS  
Most feeding on plants.

**Luna and Beyond**  
Moons in our Solar System

All of the following are moons of Jupiter except one. WHICH one?

<input type="button" value="Europa"/>	<input type="button" value="Europa"/>
<input type="button" value="Callisto"/>	<input type="button" value="Io"/>

**World Geography Trivia**  
World geographic facts that we learned this year

200

Mary

←

200

John's


	South America	Asia	North America	Africa	Australia
	200		200	200	
	400	400	400	400	400
	600	600	600	600	600
	800	800	800	800	800
	1000	1000	1000	1000	1000

Four different types of teacher-created games/activities are shown here. In the upper left is an example of Matching, in the upper right is an example of Hangman, the lower left is Rags to Riches, and the lower right is Challenge Board.<sup>4</sup>



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Fax: (650) 038-3210



[Send e-mail to Mrs. Curle](#)

[View calendar](#)

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Welcome to Physics 2A!

This week's schedule:

**Monday, April 12**

Chapter 14 problem set due. Meet in room 130A for lab.

**Tuesday, April 13**

Lecture, chapter 15, pp. 208-214.

**Wednesday, April 14**

Lecture, chapter 15, pp. 215-223.

**Thursday, April 15**

Finish ch. 15 lecture. Midterm Q & A. Don't forget review session after school from 3:45-5:00 in room 322!

**Friday, April 16**

Midterm covering ch. 9-14

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This week's assignment, due Monday, April 19: Chapter 15, p. 230, problems 1, 2, 3a&b, 5, 7, 12, 14a&c, 15. Extra credit problem 17.

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**Calendar events** ([view calendar](#))

- Today 3:00 PM - 4:00 PM [After School Study Hour](#)
- Tue Dec 21, 2004 3:00 PM - 4:00 PM [After School Study Hour](#)
- Wed Dec 22, 2004 3:00 PM - 4:00 PM [After School Study Hour](#)
- Thu Dec 23, 2004 3:00 PM - 4:00 PM [After School Study Hour](#)
- Fri Dec 24, 2004 3:00 PM - 4:00 PM [After School Study Hour](#)

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**Quia activities**

- **Famous Physicists** [edit this activity](#)  
<http://www.quia.com/9115/jg/5483.html>  
Learn the names and accomplishments of important physicists
- **Chapter 14 Quiz** [edit this activity](#)  
<http://www.quia.com/9115/tq/101068.html>  
Practice for ch. 14 test
- **phys2a** [edit this activity](#)  
Session Name: **phys2a**

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**Useful links**

- Quia science activities <http://www.quia.com/sci.htm>
- Physics 2000. Neat Java applets <http://www.Colorado.EDU/physics/2000/>
- constants, conversions, and equations <http://t.casp.co.uk/science/index.htm>

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[Quia Home Page](#)

[Quiz Session Log In](#)

Last updated 2001/12/29 20:07:49 GMT  [Quia.com/9115/9115.html](http://Quia.com/9115/9115.html) Hits: 81410

This is an example of a teacher's Web page. Notice the teacher has posted homework assignments, schedules, calendars, contact information, and links to other Web resources. This allows students and parents to be kept up-to-date with what is going on in the classroom.<sup>4</sup>

## Instructor Zone

Welcome, Alison Brown

[Comments and suggestions](#)  
[Brochures and presentation materials](#)  
[Quia Web tutorial](#)

Classes Quizzes Activities Surveys Files Preferences Admin

Basic Advanced Question Bank 

This is the **Basic** quiz tab. (What's the difference between the Basic and Advanced tabs?)

[Sample activities](#)  
[Share your activities with the world](#)

[Create a new quiz](#)

Looking for ideas? [Check out quizzes others have made!](#)

### Network

Network [what's this?](#) Help

- Entire Network [e-mail]
  - Brown, Alison [e-mail]
  - Johnson, Liz [e-mail]
  - Mays, Louisa [e-mail]
  - Peterson, Albert [e-mail]

Title and URL	Last Updated
<b>Quizzes</b>	
<b>Detecting sentence fragments</b> To give this quiz to your students, click the Distribute link.	12-07-06
<b>Español - Vocabulario 1</b> <a href="http://www.quia.com/quiz/878102.html">http://www.quia.com/quiz/878102.html</a>	12-20-06
<b>French Revolution - Quiz</b> To give this quiz to your students, click the Distribute link.	12-02-06
<b>Activities</b>	
<b>Adverbios y interrogativas</b> <a href="http://www.quia.com/pp/984674.html">http://www.quia.com/pp/984674.html</a>	12-17-06
<b>How well do you know your capitals?</b> <a href="http://www.quia.com/qa/89857.html">http://www.quia.com/qa/89857.html</a>	12-04-06
<b>Liberté, Egalité, ...?</b> <a href="http://www.quia.com/rh/39533.html">http://www.quia.com/rh/39533.html</a>	12-07-06
<b>Run-on sentences</b> <a href="http://www.quia.com/pp/57904.html">http://www.quia.com/pp/57904.html</a>	12-08-06
<b>Vocabulary Scramble</b> <a href="http://www.quia.com/jw/142112.html">http://www.quia.com/jw/142112.html</a>	12-21-06
<b>Surveys</b>	
<b>Class Evaluation Survey</b> <a href="http://www.quia.com/pp/78712.html">http://www.quia.com/pp/78712.html</a>	12-20-06

Wilkins, Jeremy [e-mail]  
Grade [e-mail]

With Quia, a district can even have its own network. Teachers can email one another and be seen on one website.<sup>4</sup>

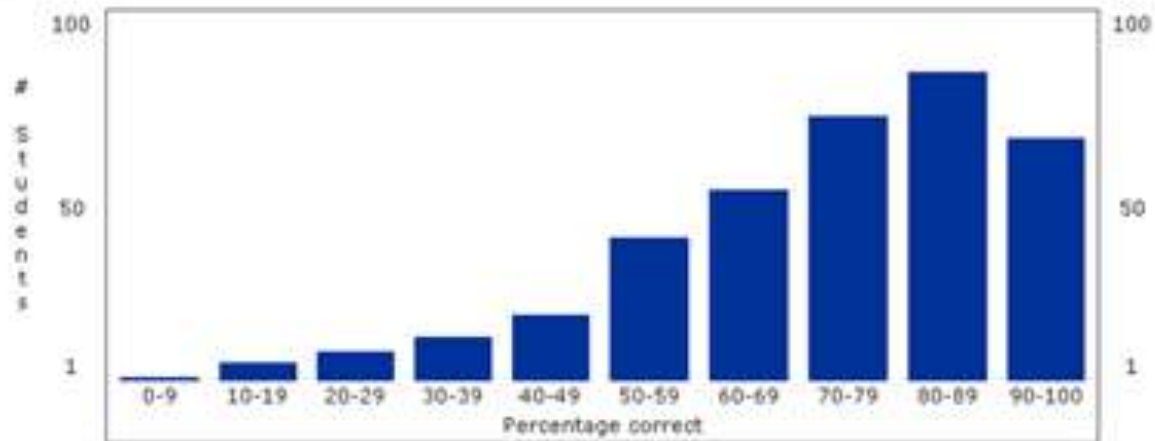
**Summary Report**  
**Activity:** Mathematics Proficiency Exam



Group by: Instructor, then by class

**Summary**

Low Score	High Score	Mean	Median	# of Students
8/100 (8.0%)	99/100 (99.0%)	75.3/100 (75.3%)	73/100 (73.0%)	339



**Report by Instructor, then by class** [\(top\)](#)

Instructor/Class	Low Score	High Score	Mean	Median	# Students
<b>Miller, Teresa</b>	<b>13 (13.0%)</b>	<b>99 (99.0%)</b>	<b>78.2 (78.2%)</b>	<b>74 (74.0%)</b>	<b>140</b>
Algebra I	14 (14.0%)	99 (99.0%)	79.7 (79.7%)	80 (80.0%)	42
Geometry	56 (56.0%)	96 (96.0%)	85.1 (85.1%)	84 (84.0%)	61
Precalculus	13 (13.0%)	89 (89.0%)	67.2 (67.2%)	65 (65.0%)	37
<b>Newman, Jeffrey</b>	<b>61 (61.0%)</b>	<b>94 (94.0%)</b>	<b>73.3 (73.3%)</b>	<b>73 (73.0%)</b>	<b>48</b>
Algebra I	61 (61.0%)	94 (94.0%)	73.3 (73.3%)	73 (73.0%)	48
<b>Putnam, Steve</b>	<b>8 (8.0%)</b>	<b>91 (91.0%)</b>	<b>66.6 (66.6%)</b>	<b>65 (65.0%)</b>	<b>108</b>
Geometry - Period 1	8 (8.0%)	84 (84.0%)	66.7 (66.7%)	63 (63.0%)	51
Multivariable Calc - Period 3	59 (59.0%)	91 (91.0%)	65.4 (66.4%)	67 (67.0%)	57
<b>Walters, Tom</b>	<b>67 (67.0%)</b>	<b>99 (99.0%)</b>	<b>88.4 (88.4%)</b>	<b>89 (89.0%)</b>	<b>43</b>
Advanced Precalculus	67 (67.0%)	99 (99.0%)	88.4 (88.4%)	89 (89.0%)	43
<b>Total</b>	<b>8 (8.0%)</b>	<b>99 (99.0%)</b>	<b>75.3 (75.3%)</b>	<b>73 (73.0%)</b>	<b>339</b>

With the challenge of meeting federal, state, and district standards, Quia offers mass testing options. Quia will then generate reports describing how the students performed.<sup>4</sup>

## Using CPS in My School

At an NCTM conference, I could not stay away from the CPS display. I kept playing with the systems and I believed that this technology would be fun and easy to use in my classroom and beneficial for my students. In addition, I knew other teachers in the school were looking at the systems and therefore, I believed the corporation would be more willing to purchase the product. Through two different grants, the Smaller Learning Communities Federal Grant and the Hewlett Packard Technology Teaching Grant, five teachers in my building teachers including myself were able to each obtain five computer tablets, five projectors, and several sets of blue response pads (see page 18) and white response pads (see page 19) in order to teach our students.

The CPS response pads are also known as “clickers.” Although I do not know the real reason that they were called this, it seems logical to me, since all you have to do is point and press on a button. When you press on the button of a computer mouse, the technical term used is “click” (hence, the term “clickers”).

Currently, I am the only teacher in my department using the clickers, but I recently shared my experience using CPS with my department and also with teachers of other departments. I wanted them to see the success that I am having using another method of instruction that has proven to be a useful tool in the education of our students. I received many valuable comments from my in-service presentation, a few of which follow. The vice principal of curriculum said, “The teachers were engrossed in the lesson. The motivation level and excitement in learning was positive.” A mathematics teacher told me, “That was the best in-service presentation that I have attended. I learned so much and I want to start right away using *e*-Instruction. Next time, I want a longer session on your topic.” A special education teacher said, “The material you presented was very valuable and interesting. I can see where it would help students learn.”

I created a handout for teaching the staff about CPS along with a twelve-question quiz over the handout. Normal lecturing involves giving a lecture on a topic being taught and then passing out a paper and pencil quiz that is graded later and passed back the next day. However, when one is facilitating an in-service workshop, there usually is not a second day to go over the quiz. I could have corrected the wrong answers and put the papers in the teachers’ mailbox, however, I wanted the teachers to see exactly how I used the systems and their advantages. So, I passed out the handouts and had the teachers read the material for themselves. Then, as a group, we discussed what we thought were the important points and interesting information in the handout. Finally, I told the teachers to turn on the clickers that I had handed out at the beginning of the in-service, turned on my computer and projector, and displayed the twelve question quiz on the white screen, one question at a time. The teachers responded to each question by inputting their answer using their response pads. Then, once everyone had responded, I stopped receiving answers by clicking on the “end” box, and the software displayed the correct answer on the screen. It also showed cumulatively how the subjects did as a group. This provided immediate feedback for the teachers, and we could discuss the correct answer until the quiz was finished. Using the clickers in this manner provided the teachers with a hands-on approach to learning about the systems. In the in-services that I have taught, it is amazing how the teachers became excited and involved in learning with this technology. My students have the same reaction.

## **Advantages of Using CPS**

The CPS provides my students with another way of learning, reviewing and/or testing over the subject matter. It also provides me with another method for presenting the material tied to my state's standards that the students are expected to learn in order to pass the graduation exam and to meet our corporation's curriculum goals for graduation. Furthermore, CPS provides students who normally do not participate in classroom activities the motivation and desire to be a part of the learning process. Having everyone participate in the learning experience builds my students' feeling of "we are all in this together," and being part of a team is an experience students need in today's world. It has helped students feel comfortable enough to ask questions at any given time about any mathematical concept. In addition, it reaches many learning styles, in particular, the visual and hands-on learners.

For the teacher, CPS allows me to be more of a facilitator and not a lecturer. In addition, I can immediately see how many of my students responded correctly and therefore further explain the material that the class has not mastered. This allows my students a second chance to learn the material and/or reinforces their knowledge, which builds their confidence in mathematical problem solving. By building their confidence, the students' desire to learn mathematics increases immensely and therefore they become successful in standardized testing circumstances, where they may have struggled in the past.

## **What is CPS?**

CPS is a system of technological use for instruction. CPS is a small electronic system that has a receiver and software. When I connect the receiver, install the software, and attach a projector to my computer, it allows me to use the response pads. Typically the system, which is controlled by the teacher, displays one question at a time on the white screen, and the students use the response pads to answer the question. The answer and the class results will show up on the screen. The teacher advances to the next question until all the questions that were in the review/quiz/test were asked and answered. Then, the teacher can see the students' scores by their response pad numbers. In addition, the teacher can see other statistics for each question and totals for each review/quiz/test. Furthermore, CPS can help engage students of all learning types. The system can be used for instructional activities, collaborative sessions, quizzes, and/or tests. One can create multiple choice, true/false, yes/no, objective, and/or subjective questions with CPS. There are many different ways that a teacher can use CPS in his or her classroom.

For example, you can use hard copy tests and have the students submit their answers at their own pace, with immediate grading for the teacher. Second, you can give verbal questions and have the students answer with immediate feedback. Third, a teacher can use soft copy questions. Soft copy questions can be obtained through Exam View, which is the test generator that comes with most textbooks that are owned by *e-Instruction*. However, if you do not have Exam View (like my mathematics department), then you can export your questions to a rich text format (.rtf) file and import them into Word, modify it to meet the CPS format (See example on page 22), save it, and then import it into CPS. Fourth, test questions can also be written directly in CPS software. The CPS kit comes with an easy to read instruction manual and helpful tech support. Last of all, you could use pre-made questions and write them on the electronic chalkboard and have students respond with the clickers. It may sound like a lot of work, but it is really not difficult. PowerPoint shows can also be imported for presentation into CPS software.

CPS provides a grade book to use with your students, saving teachers time grading and allowing them to print out individual student reports providing the student with immediate

feedback. When you use the clickers as a graded activity, quiz, or test, it records the grades automatically into the grade book. Furthermore, you can add non-CPS-generated grades. The grade book acts like other standard computer-based grade books in which you can set the format of how the grades are entered (points or percentages) and how they are computed (averaged or weighted). Also, it has an attendance feature. A teacher can transport the grade book into Excel or any program that will handle comma-delimited or comma-separated files (.csv) for record keeping.

### **Development of e-Instruction**

The company *e-Instruction* started in 1980 when Dr. Darrell Ward wanted to enhance classroom learning using technology other than a computer. He found interest in audience response systems that allowed everyone in the room to respond to a question. These systems protected the responder by not displaying the individual answers, while providing the instructor immediate feedback. The results led to the Classroom Performance Systems, known as CPS. You can find out more information about the *e-Instruction* and CPS at [www.einstruction.com](http://www.einstruction.com).

### **Research Studies**

Two small studies performed by a fellow mathematics teacher and myself in my high school based on the ideas from the research of Dr. Robert Marzano<sup>5</sup> and his colleagues regarding immediate feedback and practice are described in *What Works in Classroom Instruction*.<sup>6</sup> Our studies showed that those students who reviewed with CPS performed significantly better than those students who reviewed a more traditional way using only their textbooks. The studies were conducted during the same year, each during one trimester involving the same course taught by the same teacher during two different periods. The fact that the classes were taught at different hours is the most critical bias that these studies had, but one that was adjusted for in analysis. Both groups were given a pre-test involving a 25-question multiple choice test over the unit that was being taught. Then the teacher taught the unit for one to two weeks with a review day and a 50-question multiple choice post-test at the end. The control group was taught and reviewed only with textbook materials, while the experimental group was taught and reviewed with CPS. Both groups were given the same pre-test and post-test to make up for any intellectual differences between the two groups. We submitted the collected data to Dr. Marzano, who ran a statistical analysis (ANOVA) using software on our data and reported the results back to us. The results of the two studies were statistically significant showing that students using CPS scored better on the tests.

## CPS Hardware



This is a picture of the equipment needed to use CPS. Included is a white board, screen (as shown) or wall that will display projected images, a projector (as shown), tablet (as shown), or desktop computer, response pads for the whole class (see pages 18 and 19), the CPS software, and the receiver (the little blue, white, and black device sitting next to the projector). All of these are available from e-Instruction.

## Types of Response Pads

CPS has two types of response pads, IR and RF. Infrared (IR) response pads capture the data using a receiver. These clickers look like small television remote controls that have eight alphabetical buttons. The receiver connects directly to a USB port and is easy to use. Students need to point their response pads toward the receiver to have their responses captured.



The limited infrared (IR) response pad.

The radio frequency (RF) response pads are more powerful. Numeric entries of up to twelve characters can be entered and viewed on the three-line LCD screen. The SYM (symbol) button at the bottom allows students to give fraction and decimal answers. Furthermore, students do not have to point the clickers at the receiver in order for their responses to be captured. As with the IR pads, the receiver connects through the USB port. Computers bought within the last five years can handle the specifications for CPS usage (see page 20).



The more powerful radio frequency (RF) response pad.

## **Conclusion**

It was through the opportunity provided by the IU-IMI Mathematics Science Partnership grant to attend the summer workshop to learn mathematics modeling, Indiana Mathematics Initiative conferences and meetings that I learned about cutting-edge technology uses in the classroom. An unexpected benefit of this project has been the opportunity for me to share curriculum resources and information which has in turn allowed fellow teachers to improve their educational strategies, techniques and approaches to instruction. Furthermore, the cadre of IMI leaders and Indiana University mathematics professors and other instructional staff have encouraged and enabled me to take the difficult steps of self analysis regarding my teaching style and methods, so that I can make educationally sound improvements in my curriculum with the goal of reaching more students successfully. I will continue my quest to find technology that will allow me to use much more than a blackboard and chalk.

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## References

<sup>1</sup> Indiana Department of Education

<http://www.doe.state.in.us/standards/HS-Mathematics.html>

<sup>2</sup> National Council of Teachers of Mathematics

<http://standards.nctm.org/document/chapter7/index.htm>

<sup>3</sup> Quia Website

<http://www.quia.com>

Quia can be used on all new computers today. However, if you own an older computer, here is the minimum computer configuration that you must have to run Quia.

- At least 128 MB of RAM
- The monitor should allow you to view an 800 X 600 pixel image without scrolling. The best situation for a monitor is one having 1024 X 768 resolution and 32-bit color.
- If you want to listen to audio recordings, your computer needs headphones or speakers.
- If you want to record audio, your computer needs a microphone.
- Internet connection with a modem or network card.
- Windows 98 or newer or MAC OS 9 or newer operating system.
- Internet Explorer 6 or newer or Mozilla Firefox 1.5 or newer for a browser.
- Sun Java Plug-in for Java Applets and Adobe Flash Player for Quizzes and Games.
- Windows Media Player or QuickTime for Video and Audio
- UTF-8 encoded texts to handle different languages.

All of these items are available to download for free from the Internet.

<sup>4</sup> Tour Quia Web Now

(You can go to [www.quia.com](http://www.quia.com) which is the Quia Website, click on Quia Web, and then click on Tour Quia Web now to access these pictures.)

<http://www.quia.com/findout.html>

<sup>5</sup> Dr. Robert Marzano is the President and Founder of Marzano and Associates, a Senior Scholar at Mid-continent Research for Education and Learning (McREL), and an Associate Professor at Cardinal Stritch University. He has spent over thirty-five years in education all over the world. Dr. Marzano has taken prior research from all over the world and compiled it to write books on successful research-based practices and tools in the classroom for management, instruction, curriculum, and evaluation for teachers and administrators. Dr. Marzano earned his Bachelor of Arts degree in English from Iona College, his Masters of Education degree in Reading and Language Arts from Seattle University, and his Doctorate of Philosophy in Curriculum and Instruction from the University of Washington. He is the author of 150 articles and chapters in books, more than one hundred curriculum guides and related materials, and more than 20 books. <http://www.marzanoandassociates.com/html/staff/marzano.htm>

<sup>6</sup> Marzano, R. J., Gaddy, B. B., & Dean, C. (2000). *What works in classroom instruction*. Aurora, CO: Mid-continent Research for Education and Learning.

<http://www.mcrel.org/topics/products/110/>

**Modification Codes to Meet CPS Requirements**

<b>Label</b>	<b>Description</b>
TITLE	Lesson title (required)
True/False	True or false question type
Multiple Choice	Multiple-choice question type, up to 8 multiple-choice answers (MC8)
Yes/No	Yes or No question type
Numeric	Numerical answer question type (RF only)
ANS	Answer to the question (required)
STO and OBJ	State Standards or Objectives (not required)
MOE	Margin of Error (not required): CPS can accept a range of answers for a numeric question (RF only)
NOT	Notes (not required)

**Formatting to Meet CPS Requirements in a RTF file.**

<p><b>TITLE:</b> Addition of Whole Numbers</p> <p><b>True/False</b></p> <p>1. Four plus seven equals twelve</p> <p>ANS: F</p> <p><b>Multiple Choice</b></p> <p>4. The sum of 11 and 5 is</p> <p>a. 15</p> <p>b. 16</p> <p>c. 12</p> <p>d. 7</p> <p>ANS: B      STO: Understanding Numbers      OBJ: 3-4.2</p> <p>NOT: CPS supports up to eight multiple-choice answers (MC8).</p> <p><b>Numeric</b></p> <p>6. What is 12 plus 13?</p> <p>ANS: 25      MOE: 1</p>
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**NOTE:** Sometimes, you may see weird symbols that are bold when a file gets imported that make it so you cannot read the numbers. This is because CPS can only support the following features: superscript, subscript, pictures (.bmp, .gif, and .jpg), charts, symbols, strikethrough, and font (size, type, and color). In my experience, it has difficulty transferring the software parenthesis,

braces, and/or brackets. However, you can easily fix this problem using Math Type to edit the object. It automatically removes the strange marks that may occur.