Getting SMART with Technology Integration in the Classroom

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Abstract

This article explains a partnership between education and industry that allowed teachers an opportunity to enhance their academic content knowledge and technological competency in mathematics, science, and technology through hands-on applications. The need for technological competency of students and teachers in Mississippi’s distressed counties is currently being addressed with training and equipment being provided to some of Mississippi’s most deserving educators. Project SMART exemplifies these efforts, and the authors present promising outcomes as well as applicable online resources.

Introduction

Today, middle school teachers are expected to integrate technology into their classrooms, especially in math and science courses. School systems often provide periodic workshops or training sessions that introduce teachers to various technologies, only to find out that the teachers use the technology on a limited basis. The lack of implementation may occur for many reasons. First, teachers may see a demonstration involving Microsoft Power Point, Excel, SMART Board, or other instructional technologies, but may not have the opportunity to use the hardware and software in a hands-on fashion (Cwikla & Morse, 2005; Quinn & Valentine, 2001; Viadero, 1997). This means that if teachers want to use the technology in lesson planning, they still must have the time and initiative to develop a lesson plan from scratch. As Zehr (1997) argues, “money spent on school technology is wasted without an equal effort to help teachers with its use and integration into the curriculum” (p. 24). Second, in many school systems it may not be feasible to have the proper technology located in each classroom. If teachers have to make special arrangements to bring the technological equipment to their rooms or must take their students to another room to use it, they may lose interest in making technology a regular part of their classroom lessons. Third, many school systems may treat technology as one additional teaching tool rather than as a means of knowledge delivery. As Ćwikla and Morse (2005, ¶5) argue, technology should not be viewed simply as an “addition to [the] curriculum” but rather as a “powerful vehicle for delivering [the] curriculum.”

Background

To address the challenges facing teachers who seek to integrate technology into their classrooms, Mississippi State University’s Center for Science, Mathematics, and Technology partnered with the Appalachian Regional Commission (ARC), and North American Coal Company’s Red Hills Mine to create Project SMART (Science and Mathematics Advancement and Reform utilizing Technology). The ARC has set two key priorities. First, it desires that “Appalachian residents will have the skills and knowledge necessary to compete in the world economy in the 21st century.” Second, ARC has partnered with universities, K-12 school systems, and industries to “build a well-educated and trainable work force that is capable of competing in the world economy.”
Program Goals

The primary goals for Project SMART were:

1. To provide technology training to science, mathematics and technology teachers (grades 7-12) in ARC distressed counties.
2. To select eight teams of teachers (three teachers per team) to train in instructional technologies, and these teachers, in turn, use the training to improve their classes and to train colleagues in their schools.
3. To train teachers to use SMART cart and PASCO sensors and curriculum materials (see http://smarttech.com and www.pasco.com).
4. To provide each team with a SMART cart and PASCO materials to use in their classrooms.

Project SMART promised to enhance the academic content knowledge and technological competence of its participants through hands-on work applications. Project SMART staff and instructors felt that offering this type of technology training would address the lack of technology competency of teachers and students in the selected school districts.

The Team Approach

“Around the nation teachers are using technology to create exciting and creative learning environments where students teach and learn from each other, solve problems, and collaborate on projects that put learning in a real-world context” (GLEF Blast Newsletter, 2001, p.1). The team approach was used because the Project SMART faculty and staff felt that the team concept impacts the implementation of Project SMART at the school level and allows for sharing of technology equipment. Teachers working together in teams may provide the most powerful influence on curriculum, instruction, and school improvement (Clark & Clark, 2006). The expectations for the teams involved their attending the two-week summer workshop, attending Project SMART follow-up meetings, integrating SMART cart and PASCO sensory materials into lesson plans, participating in the evaluation process by allowing classroom site visits, and sharing training experiences with other teachers and students.

Industry Partner

Academic content instruction and research methodology were provided at the North American Coal Corporation’s Red Hills Mine in Ackerman, Mississippi. Mine personnel, in cooperation with Mississippi State University faculty and staff, conducted the workshop training. A full partner in Project SMART, the Red Hills Mine provided the building, staff, and research locations for the workshop. The construction of Red Hills Mine and its facilities began in August of 1998. Company representatives made a commitment to education through the construction of a facility to be used for workshops for teachers and students. Under the guidance of mine personnel, Project SMART participants learned about and conducted experiments on soils, air quality, archaeological and historical sites, pre- and post-mining land use, and reclamation of
the land. Throughout the workshop, various forms of technology helped to conduct and/or examine the data collected. Mining personnel also gave participants the opportunity to tour the mine and to view the massive machinery worth in excess of $60 million. While at the mine, participants met with mining engineers, environmental scientists, and management personnel to learn about the lignite mining process.

Anytime a mine becomes a part of the community, neighborhoods have concerns regarding the overall function of the mine and how the mine will affect the area in which they live. The purpose behind the Red Hills Mine’s involvement in programs like Project SMART is to educate the public regarding aspects of the industry and how the mine relates to the everyday life of those in its community. Mining officials feel they benefit from participating in educational partnerships like Project SMART by educating its future workforce of students and their teachers on various aspects of the mining industry. Visitors of the mine learn first-hand the training and skills needed to perform the duties of those currently working at the mine and the regulations of the mining industry.

**Summer Workshop**

Program participants spent two weeks in July researching the development and operation of a lignite mine while learning technology for classroom instruction. The teams of teachers met Monday through Friday from 8:00 a.m. to 5:00 p.m. and were involved in a wide range of experiential activities. The foci for all training sessions were for the teachers to use the technology and to conduct experiments along with the program facilitators. The facilitators believed that hands-on experience was the only way for the technology integration to “take root” with the teachers. Topics of sessions included coal formation, drilling, volcanics, erosion transportation, sonar mapping, GPS technology, stream flow, and ground water measurement.

To introduce the participants to the mining industry and how technology is used at the mine, two introductory activities were conducted before the participants moved on to the more advanced exercises. First, teachers used chocolate chip cookies to simulate the process of coal mining. Teachers had to remove intact chocolate chips from the cookies. The cookies could disintegrate, but each chip had to be extracted as a whole. This simulated the coal mining process and gave teachers a great way to teach this material to their students.

Second, program facilitators hid a large number of disposable cameras in an outdoor area near the mine and recorded the location coordinates. This session was referred to as a “treasure hunt.” Each team of teachers had to use its GPS systems to enter the coordinates to help them locate the cameras. The teachers were allowed to keep all of the cameras that they were able to find.
As the workshop continued, teachers participated in more advanced activities that involved identifying types and properties of soils, operation of GPS systems, environmental measurements, and PowerPoint presentations. Some of these activities are described below.

Data samples were presented that defined the type and properties of soils at various depths beneath the surface. The vertical graphs of this data were projected onto the SMART Boards; the layers were identified and colored on the boards; and then the various strata were easily tracked beneath the surface leading to a profile of usable lignite deposits shown as a function of lateral position and depth.

A satellite view of the plant was projected and used to identify the various surface features of the plant and the surrounding vicinity. The use of GPS systems in lignite mining and surface reconstruction was then overlayed. The operation of GPS probes was described using projections, and interactive web-based information was shown.

The data from environmental measurements of water pH, salinity, and turbidity were projected onto the SMART Boards where they were easily compared and contrasted. The effects of the efficient water purification at the plant were easily seen on the projections. These data were also graphed on the SMART Boards using a PASCO graphing program and interactive SMART Board features.
Gathering data

Many PowerPoint presentations were shown using the SMART Board interactive features to communicate with the computer system and the presentation software. Throughout the sessions, items from the SMART cart were introduced and a corresponding activity ensued. The program facilitators made sure that the teachers understood how to use all of the items from the SMART cart that they would be receiving for their schools. Each SMART cart included a laptop computer, SMART Board, computer projection system, digital camera, printer, and mobile cart.

Along with a SMART cart, teams received science equipment, which included sensors and probeware as well as chemistry and earth/environment laboratory manuals from PASCO Scientific. These manuals include examples of hands-on activities in science, mathematics, and technology classrooms.

Project Outcomes

A total of 24 teachers participated in the Project SMART workshop, representing eight schools in the ARC-distressed counties of Mississippi. Components of Project SMART that were implemented by teachers in their classrooms included technology skills and in-depth knowledge of the earth and its environment as it relates to a lignite mining company. Evaluation results indicated that teachers were impacted positively through the enhancement of technology skills and the integration of technology into their lesson planning. This integration of newly gained technology skills with additional resources in the sciences allowed for a strengthening of knowledge for the teachers, their students, and their fellow educators.

The teachers reported that Project Smart motivated them to use the new technology on a regular basis in their classrooms. They found that having to develop lesson plans employing the new technology gave them the structure needed to develop additional lesson plans. Teachers noted that they used the laptops, projectors, and SMART Boards on a regular basis and did not allow them to “collect dust.” The teachers seemed most comfortable using the laptops and projectors to create PowerPoint presentations for their classes.
One science teacher reported that the SMART Board significantly enhanced his classroom. He identified a website that provides in-depth displays of a cell. Using the SMART Board, he could label the parts of the cell and highlight important content on the website. This meant that all of his students did not have to crowd around one or two computers to see the presentation. All students could see the website content, as well as his drawings on the SMART Board.

A math teacher explained a similarly exciting experience with the SMART Board. He could display problems in a PowerPoint, Microsoft Word, or Internet format and work them in front of the class. He found that students were more attentive to problems worked with the technology than with a traditional chalkboard or overhead projector. According to this teacher, one especially helpful feature is that once the problems have been solved and comments written, SMART Board software allows the user to take a “snapshot” of the final screen that can be saved in a file for later use.

Demonstrating the power of the team concept, one team developed an integrated lesson plan that incorporated elements of science, math, and technology. They used the GPS “treasure hunt” exercise from the summer workshop as a model. Teachers identified several species of trees on school grounds and mapped their coordinates. Students learned how to use GPS units to enter the coordinates and to locate the trees. Students also learned the science of identifying types of trees, the technology of GPS, and the math of coordinate grids.

Initially, Project SMART will impact approximately 2,400 students (24 teachers X 100 students per day). By participating in Project SMART, teachers feel that they are better prepared to provide real-world applications of content, to provide career guidance for students, and to enhance technology use in teaching. It is expected that as the Project SMART teachers become more familiar with the technology equipment, they will also provide professional development training to teachers in their schools, which will ultimately impact additional teachers and students throughout their schools and districts.

At the follow-up meeting, one teacher said that after he completed the Project SMART summer workshop, he began to use PowerPoint presentations in his classroom as he lectured. The principal of the school saw this and shared with the school superintendent how this teacher was integrating technology into his lessons. The superintendent has since asked that all teachers in his district create at least one PowerPoint presentation per week to share with their students. Several other teachers remarked that their students love the technology, the equipment holds the attention of the students, and the technology provides more interaction between teachers and students.

Twenty-four teachers are now trained and implementing SMART cart and PASCO technology into their lessons. The partnership between industry and educators in this project increased not only the content knowledge and technological competence of teachers, but also facilitated the career awareness of the skills needed to succeed in today’s technological society.
These Mississippi teachers have a “jump start” on the implementation of the seventh through ninth grade discovery courses that have recently been redesigned to bridge the gap in technology literacy by the Mississippi Department of Education (MDE). The recently published MDE (2006) brief states that “Mississippi high school graduates will be prepared academically as well as equipped with learning and thinking skills, global awareness, information and communications technology literacy, and life skills.” This plan for the future workforce of Mississippi is to revamp the discovery courses to increase the proficiency of technology skills and show how these skills connect to workforce and academic skills.

Future of Program

As these Project SMART educators continue to disseminate their knowledge and technological expertise, their students and fellow educators will benefit. Ultimately, the state of Mississippi has benefited from the Project SMART training because 24 teachers and an anticipated 2,400 students are more aware of the skills needed in today’s workplace, can relate academic subjects to the real world, and are more capable users of technology.

Overall, Project SMART received positive comments from its participants. Survey responses indicate that the teachers appreciated the training and equipment they received for use at their schools. One participant shared, “This was a fantastic learning experience. Most of the technology we got for our school would not have been bought by the district, so we feel very fortunate to be a part of the program.” Another participant stated, “I really enjoyed the whole aspect of the workshop. The educational value was worth the time spent. The equipment was a super bonus reward.”

Relevant Online Resources

- Mississippi State University’s Center for Science, Mathematics and Technology, http://csmt.msstate.edu
- Appalachian Regional Commission, http://www.arc.gov

References


About the Authors

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