Middle School Technology: Using GIS to Create Emergency Preparedness Projects

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Abstract

The GIS Summer Technology Academy began in 2002 and will continue through the summer of 2004 for middle school students and teachers. In the academy, students create projects around topics of emergency preparation using ArcView 3.2 along with Garmin GPS units. The academy is fully funded and students and teachers must apply to attend. Site licenses are given to teachers and students receive free software as well for attending. Students create their own projects using city, state and national data. This session is geared for educators interested in securing funding for similar academies. Educators will view maps and projects created by students as well as receive handouts on the research collected from the academies. The main focus of the research identified that project-based learning with GIS promoted a positive attitudes in the students towards science, math and technology while increasing content knowledge. Grant information will also be provided.
Introduction

With national attention focused on creating more effective methods of instruction while requiring science and other secondary teachers to develop active learners, the question seems not to be whether or not project-based learning should be used, but how much it should be used in the classroom. Teachers, however, do not always have the time to create these project-based activities for their classes and seem to always appreciate the help when available. In the summers of 2002 and 2003, a summer academy entitles the Technology, Education and Collaborative (TEC) introduced students and respective teachers to Geographic Information Systems (GIS) as well as its relationship to Global Positioning Systems (GPS). Two questions were asked of this three-week summer technology academy. First, after students and teachers spend only two weeks learning about Geographic Information Systems (GIS), at which time they are provide resources and instructional needs on GIS mapping, can these students and teachers readily access data to create GIS maps? And second, will the participants’ attitudes toward GIS be adequate to provide enough motivation to pursue GIS projects in the future? Results from this study show the effect project-based learning has on student achievement and attitude.

Objectives and Standards of the Technology Academy

The objectives of the academies were as follows:

1) To teach the many uses of GPS along with GIS mapping skills;

2) To develop positive attitudes towards science and technology; and

3) To Increase collaboration through a project-based learning approach.
These objectives were measured by student and teacher responses to pre- and post-academy surveys of the content, technology, activity, and experience that each participant brought to and took away from the academy. In addition, the academy activities were aligned with the National Educational Technology Standards for Students shown in Figure 1 (International Society for Technology in Education, 2003) and the Oklahoma Priority Academic Student Skills (PASS) technology objectives (Oklahoma State Board of Education, 2002, pp.419-427).

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Figure 1. National Educational Technology Standards for Students (Source: ISTE, 2003).

<table>
<thead>
<tr>
<th>1. Basic operations and concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Students demonstrate a sound understanding of the</td>
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<tr>
<td>nature and operation of technology systems.</td>
</tr>
<tr>
<td>• Students are proficient in the use of technology.</td>
</tr>
<tr>
<td>2. Social, ethical, and human issues</td>
</tr>
<tr>
<td>• Students understand the ethical, cultural, and</td>
</tr>
<tr>
<td>societal issues related to technology.</td>
</tr>
<tr>
<td>• Students practice responsible use of technology</td>
</tr>
<tr>
<td>systems, information, and software.</td>
</tr>
<tr>
<td>• Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.</td>
</tr>
<tr>
<td>3. Technology productivity tools</td>
</tr>
<tr>
<td>• Students use technology tools to enhance learning,</td>
</tr>
<tr>
<td>increase productivity, and promote creativity.</td>
</tr>
<tr>
<td>• Students use productivity tools to collaborate in</td>
</tr>
<tr>
<td>constructing technology-enhanced models, prepare</td>
</tr>
<tr>
<td>publications, and produce other creative works.</td>
</tr>
<tr>
<td>4. Technology communications tools</td>
</tr>
<tr>
<td>• Students use telecommunications to collaborate,</td>
</tr>
<tr>
<td>publish, and interact with peers, experts, and</td>
</tr>
<tr>
<td>other audiences.</td>
</tr>
<tr>
<td>• Students use a variety of media and formats to</td>
</tr>
<tr>
<td>communicate information and ideas effectively to</td>
</tr>
<tr>
<td>multiple audiences.</td>
</tr>
<tr>
<td>5. Technology research tools</td>
</tr>
<tr>
<td>• Students use technology to locate, evaluate, and</td>
</tr>
<tr>
<td>collect information from a variety of sources.</td>
</tr>
<tr>
<td>• Students use technology tools to process data and</td>
</tr>
<tr>
<td>report results.</td>
</tr>
<tr>
<td>• Students evaluate and select new information</td>
</tr>
<tr>
<td>resources and technological innovations based on</td>
</tr>
<tr>
<td>the appropriateness for specific tasks.</td>
</tr>
<tr>
<td>6. Technology problem-solving and decision-making</td>
</tr>
<tr>
<td>tools</td>
</tr>
<tr>
<td>• Students use technology resources for solving</td>
</tr>
<tr>
<td>problems and making informed decisions.</td>
</tr>
<tr>
<td>• Students employ technology in the development of</td>
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<tr>
<td>strategies for solving problems in the real</td>
</tr>
<tr>
<td>world.</td>
</tr>
</tbody>
</table>
These standards not only show what students should know at each grade level (knowledge standards), but also what they should understand and be able to do (performance standards). The standards emphasize active learning where students are engaged in using technology. One method of engaging students in learning is to have students participate in and/or work on projects. Learning technology in math, science, language arts, social studies, and any other course can be done through a curriculum that is designed around student-generated projects; a curriculum entitled *project-based learning*.

Research shows that teachers who provide a greater amount of active learning in the classroom, assign more cooperative and collaborative activities, and place a greater emphasis on higher order thinking for students, produce students with more positive attitudes towards science and math and show a greater understanding of concepts (Zemelman, Daniels and Hyde, 1998; Gatrell and Oshiro, 2001). Gatrell and Oshiro (2001) demonstrate ways in which Geographic Information Systems (GIS), a project-based learning application used in this academy, can be utilized in classrooms instead of only using the traditional teaching approach of lecture and worksheets. This academy is also based on research by Rutherford (2002) which shows allowing students to work on groups projects in class permits them to be more creative while increasing their positive attitudes toward science and especially technology. Collaborative projects have been shown to be very beneficial to the learning process. Collaborative projects are also a major part of the National Technology Standards (International Society for Technology in Education, 2003).
The Technology

Although a wide range of technology was used during the academy, emphasis was placed on using GPS receivers to help create GIS maps. The most important goal of the academy was to develop the ability and desire in students and teachers to actively participate in activities and projects that use GIS mapping. The academy was designed so the participants could create projects in small groups while using gaining an appreciation and a positive attitude towards the technology. The goal was to create individuals confident in using GIS and GPS once leaving the academy. A brief explanation of GIS and GPS follows.

Global Positioning System

The term GPS stands for the Global Positioning System (FM 21-26, 1987). It is the only system today able to show an exact position on the Earth anytime, in any weather, anywhere on our planet. The GPS is funded by and controlled by the U. S. Department of Defense, even though studies show there are many hundreds of thousands of civil users of GPS worldwide. There are 24 GPS satellites that orbit at approximately 11,000 nautical miles above the Earth’s surface. These satellites transmit signals that can be detected by anyone with a GPS receiver. Using the receiver, a person can determine a location with great precision. One of the expected outcomes of this academy was to instruct the students on the use of hand-held GPS receivers. However, due to the skyrocketing uses for GPS technology, especially in the areas of outdoor recreation and vehicle navigation, most of the students already were well acquainted with GPS, making
time needed for this instruction very minimal. More time was available for GIS instruction, which was also found to be not as needed as thought, not because of great amounts of prior use by participants, but by the ease at which the material could be taught and learned.

Geographic Information System

A Geographic Information System (GIS) is defined as a digital database in which a common spatial coordinate system (latitude and longitude from the GPS) is the primary means of reference. Individuals can begin using a GIS by inputting data from maps, aerial photos, satellites, surveys, as well as any available data table. This data can be stored, retrieved and queried in an effort to analyze, model and describe spatial statistics regarding the data. Creating a GIS map or series of maps is an important outcome of using a GIS.

An example of data that can be used in GIS mapping is that collected by the census bureau. The sample table and map in this paper show an excerpt from the 1990 U.S. Census Report. The data is downloaded into a GIS mapping program (ArcView 3.2) and used to create a map. One goal of this academy was to instruct all teachers and students on many of the uses of GIS mapping. As previously described, the prior use of a GIS was quite unlike that of the GPS, none of the students or teachers had ever used GIS mapping, even though this technology has been available for over a decade. Surveys given to science, math and geography educators across the country showed that few individuals in education are aware of its existence or possibilities (Brown, 2002).
Below is a sample GIS data table. The information for this table came from the U.S. Census Bureau and is in a spreadsheet format (Figure 2). For the academy, students can either collect their own data or download preexisting data from the Internet or a website. All students were required to obtain data using both methods during the academy.

Figure 2. Table created by the GIS mapping software showing U.S. Census data.

Once the data is obtained and placed in a spreadsheet format, the GIS mapping software allows individuals to manipulate the data in many ways. One presentation method of the data, which the students used on a daily basis, is the creation of a map or maps. All ArcView maps can be color-coded and there are “zoom” buttons allowing users to take a world map, zoom down to the country level, then the city level, and show...
city tract maps with neighborhood topography. The following map (Figure 3) was created from the previous data.

Figure 3. Map created by the GIS mapping software showing all counties and major cities in the Southeastern United States created with ArcView 3.2.

Procedures

The 2002, Technology Education and Collaborative (TEC) summer academy was conducted at the University of Tulsa and hosted four high school teachers and 20 eighth and ninth grade students. The 2003 TEC academy hosted 35 students, five mentor students, and five teachers. The Oklahoma State Regents of Higher Education provided the funding to run the program. The academy lasted a total of three weeks each summer.
All students and teachers were required to apply for one of the limited openings and a selection committee chose the most qualified and interested individuals to participate. Once the group was selected, the teachers attended the first week of the program, a week designed for the teachers to learn how to effectively use the technology. During this week, the teachers created a plan to spend the following two weeks with the 8th and 9th grade students. The following two-weeks of the academy included attendance of the teachers as well as the student participants. During these weeks, the teachers acted as facilitators while the students learned the technology and participated in and created projects and activities based on GPS and GIS. During the second summer of the academy, student mentors attended the first week and assisted the following two weeks.

Students were quick to learn the mapping software and with their prior knowledge of GPS, ample time was available for students to experiment with a greater variety of data and maps than originally prepared for. Students began with activities from a GIS text/workbook entitled, Mapping Our World: GIS Lessons for Educators (Malone, Palmer, & Voigt, 2002), then progressed to their group projects. Each of the three major group projects were completed by all students, with the third and final project becoming a “creation” of the students instead of being created by the teachers. These included a Tulsa Zoo project, a Scavenger Hunt, and the project designed entirely by the students, the Mapping Project, which acted as a capstone activity for the students. It was this Mapping project which allowed students to demonstrate what they had learned from the academy. This project was created from a project-based learning design in which the students created their own project, not the teachers, and was based on the collaborative, social constructivist theories of Vygotsky (1978); Rist (1970); and Coley (1996); and
modern constructivist work of Solomon (1994) and Brooks and Brooks (2001). The
constructivist approach has shown that students are interpreting what they are being
taught or are experiencing in relation to their prior ideas through an interaction with
others. The Mapping project, as were all the projects, emphasized collaborative work
from its onset.

The Mapping Project

The final project for the students in each summer academy was a student-created
project. This activity was designed around a project-based learning approach, similar to
one described by Diffly (2001). In her approach, students were given a theme in which
all activities were based. For the capstone activity in both of our summer academies, a
theme was also used. The theme was based on the emergency awareness needs of
University of Tulsa students, faculty and staff. Students created their own projects based
on meeting the needs of some of the aforementioned patrons. There were five criteria for
the project. The teachers developed the guidelines for the students, yet allowed the
groups to create their projects entirely on their own. The criteria were as follows:

1) Students were to work in groups of three to five per group;
2) Groups were to submit a proposal for their project which must include a
   problem statement, hypothesis, data table, and a list of procedures that they
   would follow to collect the needed data;
3) Groups were required to stay together on the campus and collect all data,
   taking with them a teacher or faculty member;
4) Groups were to analyze the data, creating graphs and maps, and developing presentations for the final day of the academy; and,

5) All group members were required to be involved in the presentation of the projects to the audience; the audience consisted of students, parents, faculty members, teachers, members of the media, and guests.

Student Projects

Some of the questions the students set out to answer were as follows:

1) Are the storm shelters on campus and are they adequate and accessible? To answer this, students:
   - Visited every room, basement, and facility designated as a storm shelter on campus
   - Used a GPS to identify exact latitude and longitude coordinates
   - Created a digital map with digital pictures of each location
   - Collected data such as number of people each room can hold, number of exits, availability, etc.
   - Identified the number of individuals in the building who know of its existence.

2) Are the emergency telephones on campus adequate for the university population? To answer this, students:
   - Added the location of every emergency phone on campus to an interactive topographic map
• Used a GPS to identify exact latitude and longitude coordinates
• Used digital cameras to take a picture of each phone for the presentation
• Visited each phone, identifying data such as location to nearest building, number of lights within 20 feet of the phone, etc.
• Tested each phone to record response times (with permission from TU security)

3) Are there adequate numbers of fire hydrants on campus and are their locations also adequate? To answer this, students did the following:
• Used an aerial photograph to create a web page for locations
• Used a GPS to identify exact latitude and longitude coordinates
• Collected data such as location to nearest buildings, color, shape and size of hydrant, availability of emergency vehicles to hydrants, etc.
• Used a digital camera to display hydrants on their map.

4) Are the elevators on the campus adequate for the needs of the students and the faculty? To answer this, students did the following:
• Used an aerial photograph to create a web page for locations
• Used a GPS to identify exact latitude and longitude coordinates
• Collected data such as size, handicap accessibility, type of emergency contact available, age, and weight limit.
• Used a digital camera to display elevators on their map.
Data Collection for Evaluation

The data for this evaluation were from questionnaires administered to all TEC Academy participants. These questionnaires were conducted online through the academy’s WebCT website and were divided into three pre- and four post-academy surveys. The pre-academy survey categories were content, technology, and activity. The post-academy survey categories were content, technology, activity, and TEC Academy experience. The content surveys consisted of questions related to content covered during the academy such as geography, maps and map reading, basic statistical calculations (e.g., averages), and the scientific method. The technology surveys consisted of questions related to the participants’ familiarity with and use of technology related to the tools used during the academy (e.g., GPS and GIS) and best practices for technology use, safety, and security. The activity surveys consisted of questions related to the activities that participants did during their courses in the previous year and those that the participants did during the TEC Academy. These activities ranged from pedagogy and skills used in the classroom to technology exposure and experience. Finally, there was also a post-academy-only survey regarding each participant’s TEC Academy experience, in particular. This survey gave participants the opportunity to directly evaluate their TEC Academy experience, the instructors, the content, and make comments or suggestions for future academies.

The academy instructors administered the pre-academy surveys to each of the participants via WebCT during the participants’ first day at the academy, which was the first day of the three week academy for teachers and a week later for students. The post-
academy surveys were administered by the instructors via WebCT during the final day of the academy, which was the same day for both teachers and students. Participants were given time to complete these surveys online, but since responses were anonymous participation could not be required, which accounts for a drop in participant response rates between the pre- and post-academy surveys, especially among the student participants.

Each participant’s response was anonymous meaning that specific answers cannot be matched between pre- and post-academy survey items. This was done to encourage honest responses by participants, but makes the interpretation of the results less specific than if participants were linked to each item response. The anonymity of participants’ responses was achieved through the use of the online course tool, WebCT. As the basic tool for gathering and disseminating information throughout the academy, it was decided that the “survey” tool in WebCT would be used to administer the evaluation questionnaires. This WebCT survey tool reported who responded to the survey, but would not allow the user to identify which response came from which participant.

Findings

The findings of this evaluation suggest that each of the TEC Summer Academy’s objectives were met. The academies produced an increase of positive attitude towards technology, prepared students and teachers alike to readily create GIS maps, and demonstrated success of the project-based learning approach.
Objective 1: Introduce students and teachers to Geographic Information Systems (GIS) and provide resources and instructional needs to insure all students can readily access data to create GIS maps.

As one of the main foci of the TEC Academy, Geographic Information Systems (GIS) usage and experience levels both rose dramatically over the course of the academies. To determine the extent to which the 2003 academy introduced participants to GIS, participants’ responses to two questions from the pre- and post-academy “technology” survey were compared. These questions asked how often participants used Geographic Information Systems (GIS) before the academy and after attendance. Their responses ranged from “1” (never) to “4” (daily). As the first row in Table 1 shows, the frequency of participants’ GIS use rose over the course of the academy (pre-academy mean=1.11; post-academy mean=2.38). Another question from the “technology” survey asked how participants rate their experience with GIS. These responses were rated as follows: 1=none, 2=a little, 3=quite a lot, and 4=a great deal. The second row in Table 1 shows that the participants’ rating of their experience with GPS also rose over the course of the academy from “none” (pre-academy mean=1.60) to “quite a lot” (post-academy mean=2.94).

| Table 1. Indicators of Participants’ Geographic Information Systems (GIS) Use and Experience. |
|-------------------------------------------------|----------------------------------|-----------------------------------|
| Frequency of GIS use (1=never, 4=daily) | Pre-Academy (N=35) | Post-Academy (N=32) | Pre-Post Mean Difference |
| Mean | SD | Mean | SD | |
| 1.11 | 0.32 | 2.38 | 1.29 | 1.26 * |
| Rating of GIS experience (1=none, 4=a great deal) | Pre-Academy (N=35) | Post-Academy (N=32) | Pre-Post Mean Difference |
| Mean | SD | Mean | SD | |
| 1.60 | 0.74 | 2.94 | 0.67 | 1.34 * |

*p<.001
To determine whether the pre- and post-academy measures of participants’ GIS use and experience were significantly different, their responses were statistically tested using an independent samples t-test. The t-test results (indicated by the asterisks in Table 1) provide evidence that there is a statistically significant difference between the pre- and post-academy frequency of GIS use (t=-5.601, p<.001) and rating of GIS experience (t=-7.760, p<.001). This difference between the pre- and post-academy responses is also graphically illustrated in Figure 4 for frequency of GIS use and Figure 5 for rating of GIS experience.

Both Figures 4 and 5 use boxplots of the mean scores and variation in responses to the GIS use and experience questions before and after the TEC Academy. In each figure, there is a significant increase in the mean, and the range of scores does not overlap significantly. This evidence displays the fact that the pre-academy responses to these questions are significantly different and lower than the post-academy responses. Thus, the TEC Academy increased not only the frequency of participants’ GIS usage, but also their estimated level of experience with GIS mapping.
In addition to this quantitative evidence, the comments that participants wrote in response to questions in the TEC Experience survey confirm that the TEC Academy provided ample introduction to the GIS software and uses as well as the opportunity to
access resources and instruction tools for creating and interpreting GIS maps. In fact, when asked which features of the TEC Academy were the most helpful or interesting, one out of every five participants (20%) listed learning about and using GIS as the most helpful or interesting feature.

Overall, then, the results of this evaluation show that the 2003 TEC Academy introduced participants to Geographical Information Systems (GIS) and provided resources and instructional needs to insure all participants can readily access data to create GIS maps.

**Objective 2: Students and teachers alike, after spending two weeks using Geographic Information Systems (GIS), will possess a positive attitude towards the academy and the GIS software, to the extent that they would recommend the academy to their peers and consider pursuing GIS usage further.**

Tables 2 and 3 show the results of student and teacher attitudes with regards to their satisfaction with GIS experiences, their motivation to pursue further GIS experiences, and their confidence to use their computer to gather and organize information. The questions for this part of the survey were on a Likert-type scale from “1” to “5” with a “5” representing the “most agreeable” to the statement and “1” representing the least agreeable to this statement. These attitude questions were presented to the participants in both academies.

Table 2. Student attitudes toward the academy and its content

<table>
<thead>
<tr>
<th>Attitude variable</th>
<th>Participant</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>STD Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with GIS experience</td>
<td>Student</td>
<td>51</td>
<td>4.51</td>
<td>.618</td>
<td>.146</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>9</td>
<td>5.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Although the teachers on several questions gave a maximum answer of “5” (as seen with their satisfaction with their GIS experience at the academy and their desire to use computers to gather and organize information), students showed high means on questions that related to attitude towards their GIS experiences at the academy. Student made positive comments on the surveys (which were anonymous) such as, “…I liked the academy, the directors and the staff. They were all very helpful and I ended up learning a lot more than I had expected.” Another student stated, “I had a really good time. Maybe I could mentor next year?” When asked how the academy could be improved next year to increase the GIS usage by students, comments were made such as, “..it was perfect..”, “…the academy could not be improved..”, and “…everything was awesome.” When asked to share comments about the academy with the directors, one student wrote, “I seldom used computers in the past, but this has changed. I now have the confidence to use computers to do much more of my homework and projects that are given to me by
my teachers. I now have ways to improve my homework to get extra credit on it by using some of the software we learned. Thanks for all that you all have done.”

Overall, then, the results of this evaluation show that the 2003 TEC Academy was a very positive computer-based two-weeks of summer training for the students. Not only was GIS mapping, PowerPoint, and GPS heavily used in the academy, it was also done in a way which developed a positive attitude towards these and other forms of technology, meeting Objective 2 of the academy.

\textit{Objective 3: Strengthen students’ ability to work on collaborative projects and assemble group presentations using a project-based learning design.}

Collaborative learning has its roots in work done by social constructivist. Social constructivism is an epistemology of how we learn and can be practically described as allowing students to construct their own knowledge by building on what they already know through interaction with others (Vygotsky, 1978). The social constructivist point of view strongly supports the project-based classroom as well as classrooms that complete with modern technology designed for student use and discovery learning. This epistemology was the basis for the third objective of the academy.

The third objective was evaluated through three indicators from the pre- and post-academy “activity” surveys. These survey items measured the participants’ frequency of collaborative work and group presentation. In particular, participants were asked to indicate how often students worked collaboratively on projects or assignments, worked collaboratively in a variety of different ways, and made presentations to the class during the previous year compared to during the TEC Academy. As Table 4 shows, the
participants’ responses indicated that participation in all three of these activities increased during the TEC Academy. In addition, an independent samples t-test was conducted to determine if the pre- and post-academy responses were significantly different. In each case, the t-test confirmed that these increases were statistically significant.

<table>
<thead>
<tr>
<th>Collaborative Work &amp; Presentation Frequency</th>
<th>Pre-Academy (N=33)</th>
<th>Post-Academy (N=32)</th>
<th>Pre-Post Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student collaborative work</td>
<td>2.76 (0.90)</td>
<td>3.88 (0.34)</td>
<td>1.12 *</td>
</tr>
<tr>
<td>Variation in student collaborative work</td>
<td>3.00 (0.97)</td>
<td>3.75 (0.57)</td>
<td>0.75 *</td>
</tr>
<tr>
<td>Presentations to class</td>
<td>1.94 (0.66)</td>
<td>2.97 (0.82)</td>
<td>1.03 *</td>
</tr>
<tr>
<td>Mean</td>
<td>2.57</td>
<td>3.53</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.56</td>
<td>0.49</td>
<td></td>
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</table>

The open-ended questions from the TEC Experience survey confirm this finding. For example, participants indicated that some of the most helpful or interesting features of the TEC Academy were the, “…PowerPoint presentations…” and, “…working in groups.” One participant indicated that everyone might have benefited from doing, “…more group projects together.” And another participant indicated that, “…using the equipment independently…” was important, but that doing group activities was also helpful. Overall, the participants indicated that the TEC Academy strengthened their ability to work on collaborative projects and assemble group presentations.

Wording on collaborative technology-based projects, especially those designed by the students, is a key component of project-based learning. According to Lane (2004), “Students embrace technologies enthusiastically in both computer science and science classrooms, but was with so many classroom projects, application is necessary to make
learning relevant.” Project-based learning does more than just show students the technology, it allows them to take the technology, use it to solve a problem, then report the results to the class. The summer TEC academy did just that; taught GIS and GPS, allowed students to create a project needing these forms of technology to answer fundamental questions, then report the findings to the class through PowerPoint presentations, also taught at the academy.

Conclusions and Implications

The National Technology Education Standards were created to ensure that all students have the opportunity to become technologically literate before leaving their school-age years. Students cannot simply learn the terminology associated with computer technology, they must also be able to gain experience using the technology at school. The 2002 and 2003 summer Technology Academies (as well as the one being offered in the summer of 2004) attempted to meet the national standards by introducing students to GIS mapping, GPS units, PowerPoint, and many other technologies, and the analysis from two years of collected data have shown they have done a good job in meeting these objectives. Students have learned the technology, developed a positive attitude towards these technologies, and increased their amount of collaboration on projects and presentations as a result of the summer academies. And, possibly the best part of the academy, it was funded from a grant from the Regents of Higher Education from the state.

Since 1990, the Regents of Higher Education from Oklahoma have funded summer science, math and technology academies for middle and high school students in
an effort to improve math and science understanding and test scores by students. In 1990, $1.5 million dollars was set aside for these academies, a number that stayed in existence until budget problems in 2003 and 2004, in which the amount was decreased to $300,000. Fortunately, the state understands the importance of summer academies which allow students to practice what they learn. The end results of the program will be to educate a greater number of students in the summer, to increase the desire of students to pursue science and math careers, and to increase the science, math and technology literacy in the Oklahoma. When every state feels the effects of these programs, the entire nation will benefit.
Bibliography


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