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Linking Science and Technology to Personal Experience with Hurricane Katrina

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Abstract

During a high school/university collaboration, students learned several science and information technology topics related to hurricanes and produced a multimedia documentary of personal experiences with Hurricane Katrina. The purpose of this project was to motivate students to study science, technology, engineering, and mathematics topics by linking the learning activities to personal experiences with Hurricane Katrina. In addition, this project allowed students to participate in constructive activities that can help with feelings of stress and hopelessness. This project also provided an opportunity for graduate teacher education students to collaborate and conduct research with the university faculty and high school students in a technology-enhanced learning environment.

Linking Science and Technology to Personal Experience with Hurricane Katrina

Hurricane Katrina caused a tremendous disruption in the lives of people in the Gulf Coast region. Among the people affected are the students whose education and personal lives have been disrupted either through destruction of their schools and/or destruction of their homes. This project provided high school students with opportunities to use science and information technology in their own work as well as examine the role of science and information technology in topics such as hurricane preparedness and relief and recovery efforts. The analysis of critical incidents, such as natural disasters, requires contributions from several different disciplines (Carter, Kang, & Taggart, 1999). The collaboration of educators and researchers in this project allowed students to examine a variety of disciplines and technologies in the context of hurricane preparedness and hurricane disaster recovery.

This project is significant because the students studied numerous science and information technology topics that were relevant to what happened in their lives as well as what continues to happen as a result of the hurricane. The importance of relevance in learning motivation has been long established by Keller (1987). La Velle, McFarlane, and Brawn (2003) point out that one of the reasons students do not choose to study science is because students are not prepared for science experiences outside of school. In this project, the students participated in science and technology experiences that are relevant to what is occurring in their daily lives.

Schulz-Zander, Buchter, and Dalmer (2002) found that students have cooperative opportunities in problem-oriented learning when information and communication technologies are integral to the learning culture. The science websites included in the instruction provided links between informal and school-based learning (Reynolds, Treharne, & Tripp, 2003). The culminating student project included a multimedia documentary about personal experiences with

Hurricane Katrina. Working on a constructive activity related to the disaster is helpful for people who may be experiencing posttraumatic stress (Lazarus, Jimerson, & Brock, 2002; Vernberg & Vogel, 1993).

Purpose

The purpose of this project was to motivate students to study science, technology, engineering, and mathematics topics by linking the learning activities to personal experiences with Hurricane Katrina. In addition, this project allowed students to participate in constructive activities that can help with feelings of stress and hopelessness.

Method

In this project, students attended a summer class entitled *Special Topics in Information Technology: Hurricane Experts, Leaders, and Problem Solvers (HELP)*. The students fulfilled roles of reporters or production editors as they collaborated with each other, with university faculty and graduate students, and community members to interview and record personal experiences with Hurricane Katrina. The students operated a variety of hardware devices (computers, digital photo cameras, digital video cameras) and software programs (digital photo editing, digital video editing). The students participated in science, technology, engineering, and mathematics learning experiences that included interactions with professional role models in the various disciplines.

The following research questions were developed for this project.

- Will participation in the program influence students' attitudes toward science?
- Will there be a difference between groups (reporters and production editors) in their attitudes toward science following completion of the program?
- Will participation in the project influence students' attitudes toward computers?

- Will there be a difference between groups (reporters and production editors) in their attitudes toward computers following completion of the program?
- Will students report higher levels of experience with technology following completion of the program?
- Will there be a difference between groups (reporters and production editors) in their reports of levels of experience with technology following completion of the program?
- What information will students provide in advisory reports related to hurricane recovery?
- What information will students select for inclusion in a multimedia documentary related to hurricane recovery?

Participants

Participants in the program included 17 students affected by Hurricane Katrina. Students were randomly assigned to fulfill a role either as a reporter or production editor in the development of the multimedia documentary. Two participants were out of town with family members and were unable to continue with the final week of the class. The remaining 15 participants ranged in age from 13 to 18 and included 9 males and 6 females. Demographic reports of race showed three African-American or Black (non-Hispanic) students, 11 Caucasian or White (non-Hispanic) students, and one member of another group or more than one group.

The high school attended by the students is designated as a Title I school with 1,500 students. The school is located in a coastal community in Alabama. The participants were recruited with the assistance of the school principal, assistant principal, school counselor, and teachers. Flyers were posted and distributed in classrooms for students to take home. Incentives

for the participants included one-half course credit, a copy of the final documentary CD, and development of critical workforce skills that can be included on a resume.

Instruments

A brief demographic questionnaire was included for information about the student participants.

To examine student interest in science, a questionnaire with 19 science-related items from the *Attitude Toward Science and Mathematics Scale* (Teshome, Maushak, & Athreya, 2001) and one new item was administered on the first and last day of the program. For this study, only the items related to science attitude, gender issues, participation in science activities, need to know science, and the importance of science were selected.

For interest in information technology, the *Computer Attitude Questionnaire* (Knezek, Christensen, & Miyashita, 2000) was administered on the first and last day of the program. The developers of the 7-part instrument reported eight constructs in the factor analysis (computer importance, enjoyment, motivation, study habits, empathy, creativity, anxiety, and seclusion). For this study, only the items from Part I related primarily to computer importance, enjoyment, and anxiety were selected. In addition, a 10-item *Level of Experience with Technology Scale* was developed for students to indicate their levels of experience with specific technologies used in this project. A 4-item *Computer and Internet Use Scale* included questions on frequency of computer and Internet use.

Sensitivity to the students' emotional well-being was paramount. Because the students may have experienced posttraumatic stress as a result of the hurricane, a pre/post administration of the *Impact of Event Scale - Revised* (Devilly, 2004; Horowitz, Wilner, & Alvarez, 1979; Sundin & Horowitz, 2003; Weiss & Marmar, 1997) was included. A complete description of the

scale and the scoring procedures are available from http://www.swin.edu.au/victims/resources/assessment/ptsd/ies-r.html (Weiss & Marmar, 1997). The *Hostility-SCL-90* and the *Modified Depression Scale* were also administered. One open-ended written-response question was developed to ask students to describe how things have been going for them since Hurricane Katrina, what has been difficult, and what has been helpful. The counselor educators collaborating on this project examined the results and were available to assist students if needed.

During the project, students received a weekend assignment to interview community members regarding their needs for hurricane recovery. The students brought their interview notes to class for discussion. At the end of the project, students received printed instructions to write a letter to a friend and describe their learning experiences and indicate if they would recommend the special class to a friend. On the last day of the project, five students were interviewed individually about their participation in the project.

Procedures

The students attended the class four days a week for three weeks (Monday – Thursday, 8:30 a.m. – 1:00 p.m.) during the month of June 2006. Bus transportation was provided for the students. The project agenda included the activities listed below.

Day 1 Location: High School
Administration of research instruments, Orientation, Random assignment to groups (reporters or production editors), Brainstorming Project Ideas, Hands-on Exploration of Hurricane-related Web Sites

Day 2 Location: University
Visit to Coastal Weather Research Center/Observation of Hurricane Tracking Information Systems

Visit to College of Engineering/Observation of Wave Action Simulator
Instruction in College of Engineering Computer Lab/Hands-on Use of Computer-Based Tutorial on Types of Waves

Day 3 Location: High School
Instruction in Hurricane Tracking and Graphing/Hands-on Use of NOAA Web site

Instruction on Interviewing with Sensitivity, Discussion of Personal Experiences with Hurricane Katrina

Day 4 (Two Locations)
Visit to Water and Sewer System, Instruction on Water Services and Hurricane Preparedness/Use of Geographic Information Systems

Visit to Dauphin Island Estuarium, Self-Guided Exploration of Hurricane Effects on Marine Life

Day 5 Location: University
Hands-on Instruction on Shooting and Editing Digital Photos

Instruction on Composition for Shooting Video

Day 6 Location: University
Hands-on Instruction on Shooting and Editing Digital Video

Instruction on the Science of Hurricanes

Day 7 (Two Locations)
Location: University
Hands-on Instruction on Multimedia Movie Production

Location: Local Television Station
Instruction on Behind the Scenes of Television Broadcasting

Day 8 Location: Numerous community locations
Bus Trip to Numerous Community Locations to Interview, Videotape, and Photograph Community Members and Scenes of the Destruction

Day 9 Location: University
Hands-on Instruction on Storyboarding

Discussion of Community Interviews Conducted by Students as a Weekend Assignment

Day 10 and Day 11 Location: University
Hands-on Production of Multimedia Documentary

Day 12 Location: High School
Administration of Research Instruments, Collection of Student Letters, Interviews with Individual Students, Presentation of Multimedia Documentary, Project Debriefing

Data Analysis

Descriptive statistics were analyzed for the *Attitude Toward Science Scale*, the *Computer Attitude Questionnaire (Part I)*, the *Level of Experience with Technology Scale*, the *Computer and Internet Use Scale*, the *Hostility SCL-90*, the *Modified Depression Scale*, and the *Impact of Event Scale – Revised.* Estimates of reliability for internal consistency were computed for all scales using Cronbach's alpha. Results for all scales indicated satisfactory reliability. For purposes of brevity, the complete descriptions are not included here. Factor analysis was conducted for the *Attitude Toward Science Scale*, the *Computer Attitude Scale – Part I,* and the *Impact of Event Scale - Revised.* T-tests were conducted for group differences on the factor scores.

Analysis of Covariance (ANCOVA) was used to examine a main effect for group assignment and changes indicated on the *Attitude Toward Science Scale,* the *Computer Attitude Scale (Part I)* and the *Level of Experience with Technology Scale*. The independent variable was group assignment (reporter or production editor). The dependent variables were attitude toward science, attitude toward computers, and level of experience with technology. The covariates were prior attitude toward science, prior attitude toward computers, and prior level of experience with technology. Additional comparisons were made for gender. The assumption of homogeneity of regression was checked and the results indicated that the regression slopes for the covariates and the dependent variables were not significantly different for group assignment or gender.

Qualitative data analysis included content analysis of the open-ended student responses regarding hurricane recovery, interviews with students, community interviews conducted by the students, and letters written by the students with a search for emergent themes and patterns. Multiple reviewers analyzed and triangulated the qualitative data to provide evidence of validity.

Results

Attitudes Toward Science

Attitudes toward science were examined with results from the adapted *Attitude Toward Science Scale* (Teshome, Maushak, & Athreya, 2001). The 5-point Likert scale included the following response choices: Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1. The Ns, means, and standard deviations for group assignment are shown in Table 1. The one-way ANCOVA results showed no significant differences between the groups $F(1,12) = .44$, $p = .51$.

Table 1

Attitude Toward Science Group Comparison

	Reporters N = 8		**Production Editors N = 7**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	3.65	3.63	3.61	3.43	3.63	3.54
SD	.51	.67	.78	.58	.62	.61

A comparison of gender indicated differences where females showed an increased mean on the posttest and males showed a decreased mean as shown in Table 2. The one-way ANCOVA results showed a statistically significant difference between males and females $F(1,12) = 4.95$, $p = .04$.

Table 2

Attitude Toward Science Gender Comparison

	Males N = 9		**Females N = 6**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	3.77	3.43	3.42	3.70	3.63	3.54
SD	.60	.60	.65	.65	.62	.61

Factor analysis with Varimax rotation was conducted for the *Attitude Toward Science Scale* with both the pretest and posttest results. The pretest items loaded on three factors (Factor 1 with 3 attitude, 4 importance, and 4 participation items; Factor 2 with 2 attitude items, 1 participation, and 1 importance item; Factor 3 with 5 gender items). The posttest items loaded on four factors (Factor 1 with 1 gender item, 2 attitude, 4 importance, and 3 participation items; Factor 2 with 1 gender item, 1 importance item, 2 attitude, and 2 participation items; Factor 3 with 3 gender items; Factor 4 with 1 attitude item). The gender item in Factor 1 had the word importance in the statement as did 4 other items on that factor. The reason for the gender item loading on Factor 2 is unclear.

Attitudes Toward Computers

Attitudes toward computers were examined with results from the *Computer Attitude Questionnaire (Part I)* (Knezek, Christensen, & Miyashita, 2000). The 5-point Likert scale included the following response choices: Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1. The Ns, means, and standard deviations for group assignment are shown in Table 3. The one-way ANCOVA results showed no significant differences between the groups $F(1,12) = .008$, $p = .93$.

Table 3

Attitude Toward Computers Group Comparison

	Reporters N = 8		**Production Editors N = 7**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	4.28	4.16	4.27	4.12	4.27	4.14
SD	.38	.64	.26	.57	.32	.58

A comparison of gender indicated no differences as shown in Table 4. The one-way ANCOVA results confirmed no differences between males and females $F(1,12) = 1.04$, $p = .32$.

Table 4

Attitude Toward Computers Gender Comparison

	Males N = 9		**Females N = 6**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	4.31	4.06	4.22	4.26	4.27	4.14
SD	.27	.64	.40	.52	.32	.58

Factor analysis with Varimax rotation was conducted for the *Computer Attitude Questionnaire (Part 1)* with both the pretest and posttest results. The pretest items loaded on four factors (Factor 1 with 4 importance and 5 enjoyment items; Factor 2 with 4 anxiety items; Factor 3 with 1 importance item, 1 anxiety item, and 2 enjoyment items; and Factor 4 with 3 anxiety items). The posttest items loaded on three factors (Factor 1 with 5 importance, 3 enjoyment, and 2 anxiety items; Factor 2 with 4 enjoyment and 2 anxiety items; and Factor 3 with 4 anxiety items).

Computer and Internet Use

The results from the 4-item *Computer and Internet Use Scale* indicated a high frequency of computer and Internet usage by the participants at the beginning of the program. Regarding computer use at home, 93.3% of all participants indicated they use a computer at home every day. The other 6.7% indicated they use a computer at home once a week. For Internet usage related to school assignments, 20% of the participants indicated they use it every day and 26.7% indicated they use it once a week. Results were similar at the end of the program.

Experience with Technology

The 10-item *Level of Experience with Technology Scale* was developed for students to indicate their levels of experience with specific technologies. Analysis of the results focused on the five technologies used in this project: Digital Camera, Digital Video Camera, Photoshop Elements, Windows Movie Maker, and Microsoft Producer. The 4-point Likert scale included the following response choices: No Experience = 1, Beginner = 2, Intermediate = 3, Advanced = 4. The Ns, means, and standard deviations for group assignment are shown in Table 5. The one-way ANCOVA results showed no significant differences between the groups $F(1,12) = .003$, $p = .95$. The means for all participants, however, indicated a marked increase at the end of the program.

Table 5

Level of Experience with Technology Group Comparison

	Reporters N = 8		**Production Editors N = 7**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	1.87	2.82	2.05	2.94	1.96	2.88
SD	.66	.53	.89	.67	.75	.58

A comparison of gender indicated no differences as shown in Table 6. The one-way ANCOVA results confirmed no differences between males and females $F(1,12) = .108$, $p = .74$.

Table 6

Level of Experience with Technology Gender Comparison

	Males N = 9		**Females N = 6**		**All Participants N = 15**	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean	1.88	2.86	2.06	2.90	1.96	2.88
SD	.86	.63	.62	.56	.75	.58

Psychological Measures

The *Impact of Event Scale - Revised*, the *Hostility-SCL-90*, and the *Modified Depression Scale* were analyzed to monitor the students' emotional well-being. The *Impact of Event Scale - Revised* includes three subscales (Avoidance, Intrusions, and Hyperarousal) with the following response choices: Not at all = 0, A little bit = 1, Moderately = 2, Quite a bit = 3, Extremely = 4. The items are related to thoughts and feelings about the specific event named on the questionnaire. For purposes of brevity, the complete analysis is not included here. The means for all subscales on the pretest and posttest were <1. Similar results were found with the *Hostility-SCL-90*. The results of the *Modified Depression Scale* were similar but indicated participant improvement from the beginning of the program (M = 1.13, SD = .96) to the end of the program (M = .91, SD = .91). The 6-item scale asks participants to indicate how often they experienced the stated feelings in the last 30 days. The scale includes the following response choices: Never = 0, Seldom = 1, Sometimes = 2, Often = 3, Always = 4.

Student Interviews, Discussions, and Writings

One class assignment required the students to talk with community members regarding current needs with the hurricane recovery. The students then discussed their findings in class and wrote summaries. The summaries focused on the continuing needs related to job losses, rebuilding homes, and planning for future hurricane seasons. The student summaries also included references to how the hurricane brought people together to help each other. The students themselves showed similar feelings in written paragraphs that were included with the questionnaires at the beginning and end of the program. Students were asked to describe how things have been going for them since Hurricane Katrina, what has been difficult, and what has

been helpful. Descriptions of community building, working to clean and repair the damages, and empathy for others were evident in their writings.

On the last day of the project, five students were interviewed about their experiences with the class and how their feelings about Hurricane Katrina may have changed. The interviews revealed similar results to the open-ended responses written by the students and the information students gathered in the community. In the interview discussions, the students showed positive attitudes toward moving forward with hopes for the future. The students also described the benefits of the "release" that came with making the documentary.

At the end of the project, the students wrote a brief letter to a friend describing what they learned and enjoyed about the class. Overall, the letters were highly positive. References to the science and technology topics were apparent throughout the letters. The following topics were described: formation of hurricanes, tracking hurricanes, graphing hurricanes, formation of waves, weather and "the equipment they use," working with computers, how to make movies/use MovieMaker software, digital photo editing, digital photography, use of digital cameras and digital video cameras, and video production. The letters also included social and community-related descriptions such as developing a greater awareness of the destruction and the hardship of others, interviewing people, meeting different people, and enjoying the class because of the "odd assortment of people that came together for a common cause." The students indicated concerns about having enough time to work on the documentary. One student illustrated this point when she wrote, "The thing I liked most about the class was putting the movie together. It was a big challenge but we did it. One thing I did not like was we didn't have enough time." One student stated that the class was sometimes tiring. Descriptions such as interesting, great, fun, and

"nothing boring," were written in the letters. One student wrote at the end of his learning description, "This experience was fun to me because of these reasons and the field trips."

Final Documentary Development

The development of the final documentary was a collaborative effort of the high school students, the graduate students, and the university faculty. The high school students spent considerable time in developing the documentary and selecting video clips of interviews and photographs that showed current stages of disrepair. At the end of the project, the students showed great attention to detail in the final documentary. During a class discussion about the final edits, the students developed a list of finer details such as making sure all names were included in screen titles for the videotaped interviews. The students met "a big challenge" during this summer class.

Implications for Secondary Education

This project required the use of information technology within applications of science, technology, engineering, and mathematics (STEM) fields. The students received guidance and instruction from university faculty and professional role models from a variety of disciplines. The students fulfilled actual work requirements that included critical thinking and problem solving, gathering and analyzing information, communicating orally and in writing, collaborating with culturally diverse members of a team, and organizing and presenting information with the use of information technology.

Implications for Graduate Teacher Education

Most of the graduate assistants working on this project were teachers and/or media specialists enrolled in a graduate educational research class. The graduate assistants' participation was associated with an optional assignment for the class. This project provided an

opportunity for the graduate assistants to collaborate and conduct research with the university faculty and high school students in a technology-enhanced learning environment. The graduate students also had the opportunity to gather information about student motivation in science and information technology, the use of digital technologies, the design of learner-centered activities, and the management of a technology-enhanced learning environment.

Limitations

The primary limitation of this study is the small number of students who participated. Additional limitations are associated with statistical analyses of Likert-scale data derived from self-reports.

Conclusion

One positive indicator about the project is that the students attended this class voluntarily during the summer. Although the students received credit for an elective course, their commitment to this project during the summer should be lauded. In addition to the research data collected for this project, digital photos and videos taken during learning activities serve as a chronicle and evidence of the science and technology standards met with this project. The attitude toward science results for females are especially encouraging in showing this as a way to interest females in science. Further studies should explore reasons for the opposite directional changes for males and females in their attitudes toward science.

Through participation in this project, students developed advanced technological skills and used those skills to express the feelings of a community recovering from Hurricane Katrina's devastation. At the same time, they had the opportunity to explore their personal feelings and empathize with others. The documentary provides lasting evidence of the work completed in this high school, university, and community collaboration.

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http://www.oar.noaa.gov/k12/html/teacherinfo.html

http://www.nhc.noaa.gov/HAW2/english/history.shtml

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