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Mathematics, technology, and gender: Closing gender differences with a high school web site

Steven Lee Holifield

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MATHEMATICS, TECHNOLOGY, AND GENDER:
CLOSING GENDER DIFFERENCES WITH A HIGH SCHOOL WEB SITE

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Instruction Technology Option

by
Steven Lee Holifield
March 2001
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Approved by:

Sylvester Robertson, First Reader

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ABSTRACT

Society has a profound influence on the roles individuals accept to help define them. As children, we are molded and pressed into a personality that groups us into a subset of the human population and behave accordingly. For good and/or bad, we accept stereotypes of race, age, religion, gender, and socioeconomic status in order to "fit" into and be accepted by the subgroup. Moving away from these expectations is often known as being unacceptable. In the mathematics classroom, gender differences become apparent beginning in middle school and continue into adulthood. Positive attitudes diminish and anxieties build in females as we see them move through the curriculum of mathematics and in the increasing use of technology. This project is twofold. First, it focuses on the side of technology to help motivate young females to make use of a high school web site to lessen anxieties and increase interest in mathematics and the use of technology. Secondly, it will act as a model of how to create an educational web site that brings about better communication within a community.
ACKNOWLEDGMENTS

This project contains countless hours of research and development that could not have been completed without the support of family and friends. To all who helped I express my deepest gratitude. In particular, I would like to recognize and thank Patty Barr for her expertise with webpage development, her creative ideas, and help with all the grunt work. For those times when I felt like giving up, I thank my wife, Christine, who refocused my attention on the end goal. And to my children, Brianna and Brandon, I dedicate this project to encourage their mathematical and technological growth and understanding.
<table>
<thead>
<tr>
<th>CHAPTER ONE: INTRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>How Gender Stereotypes Develop</td>
</tr>
<tr>
<td>Statement of the Problem</td>
</tr>
<tr>
<td>Significance and Overview of the Project</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER TWO: REVIEW OF RELATED LITERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender Differences</td>
</tr>
<tr>
<td>Overcoming Gender Differences</td>
</tr>
<tr>
<td>Staff Development</td>
</tr>
<tr>
<td>Authoring Systems</td>
</tr>
<tr>
<td>Conclusion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER THREE: STATEMENT OF OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Goal</td>
</tr>
<tr>
<td>Project Objective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER FOUR: DESIGN AND DEVELOPMENT OF THE PROJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose of the Project</td>
</tr>
<tr>
<td>Design</td>
</tr>
<tr>
<td>Authoring the Web Site</td>
</tr>
<tr>
<td>Formative Evaluation</td>
</tr>
<tr>
<td>Limitations of the Project</td>
</tr>
</tbody>
</table>
Recommendations for Future Projects .......... 78

APPENDIX A: A WORD ABOUT STATISTICAL ANALYSIS .......... 80
APPENDIX B: SCREEN SHOTS ..................................... 82
APPENDIX C: SOFTWARE EVALUATION FORM ............... 84
APPENDIX D: SURVEYS ............................................. 85
REFERENCES .......................................................... 86
LIST OF TABLES

Table 1. Math/Technology Relationships . . . . . . . . . 25
Table 2. BBHS Navigational Links . . . . . . . . . . . . . . 67
CHAPTER ONE:
INTRODUCTION

How Gender Stereotypes Develop

Countless research studies have been conducted on the differences between males and females in terms of success and attitude toward mathematics. As reported by the National Science Board Commission on Precollege Education, girls tend to take fewer courses in mathematics, science, and technology than do boys. Many of the research articles I have read indicate these gender differences become apparent during high school. According to an article titled, "What's a Nice Girl Like You Doing In a Math Class?", Patricia Campbell (1986) reported that similarities between the sexes in math achievement were found more frequently than differences in the elementary years. But in high school and beyond, the sex differences found in mathematics achievement favor boys. It is well documented that too many females and ethnic minorities emerge from the elementary and secondary schools with an inadequate foundation in the fields of mathematics, science, and technology.

With this group of students being the majority in the classroom, it is vital that research continues to bring
about results that indicate ways to improve performance. Being a high school math teacher and technologist, my focus for this thesis was to discover if a relationship exists between math and technology in terms of students' anxieties and attitudes. I wanted to see if research supports the use of technology as a means of improving a student's view of mathematics thus decreasing the gap between the genders.

Society plays a critical role in the development of young adults. At a young age, girls and boys discover that math is intended for males. As children, we are molded into who we are expected to be through various avenues. "Boys are encouraged to build, to play soccer, air hockey, and chess, and play with action toys, and as a result learn about math concepts" (Boland, 1995, p. 7). Our first encounter with gender stereotyping occurs before we step foot into the classroom. Boys receive gifts of cars and blocks that build a mathematical foundation while girls receive dolls, dress up clothes, and diaries. Girls are expected to keep clean and to obey the rules. Boys however are expected to wrestle, get dirty, and to trek into unknown areas.

I often find myself holding my tongue when I see my four-year old son playing with my five-year old daughter's...
Barbie dolls. The fact that they are her dolls makes me realize the underlying stereotypes I place on my children.

As stated by Gipson (1997),

"Mothers tell stories to their children and friends about the horrible experiences they had in math and science classes. Tales prevail about the workplace computer monster. Teacher expectations, parents' perceptions of their children's math ability, parents' phobias passed on to their children, and society's formal and informal policies of stereotyping have a significant emotional, social, and academic effect on girls' attitudes, interest selection, and participation in computer technology, (math), and science courses." (p. 41)

As children grow older they find other factors that influence their attitudes with a subject. The media shows commercials intended for boys that excludes and influences girls not to play with the item being advertised.

According to Knupfer (1997), these commercials are fast paced, show aggression, are rugged, and use various camera angles. Commercial intended for girls use slower tempos, are usually indoors, and use camera angles that slant down placing girls in a less dominate position. I recently watched a commercial depicting army soldiers wearing female attire. The ad for a popular overnight mail service puts blame on other mail services for not delivering the appropriate attire in time. This commercial draws a line
between mixing toys intended for boys with doll clothing intended for girls.

As children enter school they find teachers, counselors, and classroom materials influence their opinions of what many call male dominated classes. In terms of mathematics, boys have a jumpstart before entering the kindergarten classroom. Research supports the fact that girls lack spatial visualization skills that boys have accredited to playing with Legos or other building materials as children. In technology use, factors include a majority of software developed largely for boys by boys, Summer camps that are male dominated, the tendency for girls to let boys be the computer guru, which all give the impression that computers are intended for boys (McLester, 1998). However, studies show no significant differences in attitudes between the genders in math or technology at the elementary level. It isn’t until middle school that we see differences emerge between the genders (Boland, 1995).

As children enter high school they are encouraged to participate in the selection of their courses. Guidance counselors and parental influence often send the message that technology, math, and science courses are intended for males. According to Sadker (1999), girls are more likely
to enroll in clerical courses involving word processing technology where boys are more likely to enroll in computer design and advanced computer coding classes. With the fact that all students in the main population are required to meet the same A to F requirements, the alarming finding is what females generally choose to take. Females will opt to take a less demanding course of mathematics and technology. In addition, males are more likely to choose a fourth year of mathematics as an elective course.

In the classroom, teachers often enforce these stereotypes unknowingly. According to several studies, "boys are spoken to more frequently and are asked more higher-order thinking questions" than girls (Gipson, 1997, p.41). When teachers offer help, females are often shown step-by-step how to complete a project where males receive only general instructions. This lack of challenge or low expectations for females is clearly read. The message is they are incapable of completing an assignment given the same instructions as their male counterpart. The lack of female role models in science and mathematics also detours females away from these courses. Similar findings are found in computer application classrooms. Studies show that teachers are significantly more likely to ask a boy a
computer question than a female. Males are more confident in their ability to use computers and have positive attitudes towards computers than females (Kirkpatrick, 1998). In support of this project, Kirpatrick states, studies have revealed;

"...differences in attitudes and achievement levels correlate to types and amounts of computer use,...(and) that the more time students spend learning on computers, the fewer differences there were in male and female achievement" (p.57)

Many factors influence our career decisions. Usually beginning in the middle school, "girls see math as a male subject, and if they perceive the world of mathematics as a male-dominated place in which they do not belong, they will begin to make educational and career decisions that exclude math" (Boland, 1995, p.9). The courses we choose to take, how well we do in those courses, and our attitude towards those courses will play an important role in students' career choices. If we encourage females to pursue careers involving math, science, and technology, then we ensure that half of the population will have the chance to hold careers where computers are certain to dominate our lives at home and at work.
Statement of the Problem

Research studies, backed by the results of standardized tests, show that female students in mathematics, as a whole, score less than males. Even though this issue has been addressed and analyzed, current research indicated that we have only begun to make positive influences in narrowing the gap between genders (Sadker 1999). Many school districts have opened female only courses in male dominated classes, but others resist making this change for lack of knowledge and monetary reasons. Individuals who know the needs currently not being met can cohesively make a positive change in what is currently being found as an injustice. It is best said by John Stuart Mill, "One person with a belief is a source of power equal to ninety-nine whom have only interests".

With this empowerment, one or a selected few can implement the ideas suggested by research on improving the education of all. When one allows a group the size of half the population to improve in ability, as a whole we take further strides in becoming a more intellectual species. Implementing one strategy designed to close the gender gap can make a notable difference (Boland, 1995). Adults emerging from said changes will be the future role models
who will in turn encourage young girls to take advantage of the mathematics and technology that will help to define their future.

We can not achieve equality unless we value the needs and interests of both genders. As a society, we need to become more aware of the problems faced in educating all students. Females who enter secondary school with a heightened sense of interest in mathematics will surely perform better in technology and science. These courses will act as a bridge supporting women in satisfying careers involving these male dominated courses.

Significance and Overview of the Project

Increasing technology use in the curriculum will statistically improve achievement in mathematics (Waxman, 1996, & Shashanni 1993). This project of creating a high school web site, is an attempt to increase technology use. It will challenge instructors to overcome technological phobias by creating sites with educational value. Students will be required and/or encouraged to make regular use of the web pages and the vast amount of resources found in the technological world known as the Internet.

Each instructor will have a reserved space on the global site to express his or her creative ideas. Staff
development will take place for individuals to become accustom to the authoring tool, Claris Home Page, and will find support in creating their classroom technological resource. Monetary incentives will be offered to help motivate staff to take advantage of these inservices and one on one support will follow when desired.

Linked from the main page will not only be teacher sites offering educational value, but also general information all students, community members, and staff members will find useful as being part of our small town community and school. It will include an area where alumni can inquire about upcoming reunions and submit personal information to be shared with other alumni. Students will find a link to our Career and Media Center where they can look up media using our online catalog or find updates on career and scholarship opportunities. Of interest to the community, this site will contain current rosters, schedules, and directions of upcoming events for both athletics and the student body. For many instructors it will be used as an alternative source of communication between home and school. Throughout this project, a goal will be to allow all those who wish an opportunity to play
a part in the creation and continued tweaking of this "living" project.

Through the creation of this project and beyond, parents and students will use the site as a source of information for many classes. Home computers and single user computers found in the school's media center provide a comfortable atmosphere for females to interact with the technology in various ways. Studies have shown that if one can place females in a setting away from males, they will not only take control but exhibit similar sense of confidence found in boys.
CHAPTER TWO:

REVIEW OF RELATED LITERATURE

Gender Differences

This section of chapter two brings together literature that supports the bulk of this study. Like most statistical research, these quantifiable studies involve using sample subjects from the population of interest. These subjects are tested and the data undergoes various statistical measures that bring out findings the researchers may or may not have intended on. These statistical findings are reported to give weight to the results. There is a very large difference between a study that reports findings at the .01 vs. the .001 confidence levels. Basically the latter decimal indicates ten times the confidence at .01. Should questions arise, provided in this document is a summary of statistical measures in APPENDIX A.

Various research studies have been conducted on gender differences in math, science, and technology. Being a high school math teacher and technologist, I wanted to see if research supports the integration of technology as a means to decrease the anxieties found in the mathematics classroom. This body of information supports that gender
differences begin to occur in the middle school. It will correlate attitudes and satisfaction a student has with math to that of technology. Further, the studies will suggest strategies to create a positive attitude toward these courses.

The purpose for this first study, conducted by Robertta Barba and Cheryl Mason (1994) was to determine whether or not children stereotype technology-related careers in the same way they stereotype science-related careers as being undesirable. It was hypothesized that attitudes of children would match the overall adult opinion that computer users hold science related careers. The survey used 5,971 kindergarten through twelfth grade students from California, New Mexico, and Pennsylvania. The students came from various socioeconomic backgrounds and the five major ethnicities were represented. Of the 5,971 students, 4,882 were classified as elementary students and the remaining 1,089 were classified as secondary students.

The researchers prompted the regular classroom teachers to have each of their students create a drawing of a computer user. Barba and Mason (1994) recorded the number and type of occupation, gender of the computer user,
and the amount of computer hardware indicated in the drawings. The results of the study indicate that elementary students saw the computer as being a tool that aids people regardless of occupation. In fact, students at this level depicted 32 different careers as being associated with computer usage. Only 2% of the elementary students drew what the researchers classified as a "Nerd". A shift was found between the elementary and secondary students. At the secondary level, students typically classified computer users into three categories; education 23.6%, business 19.2%, and "nerd" 17.9%. Only indicating a total of 10 different careers, secondary students generally see computer-related careers as being an undesirable career choice. It was rejected that children's attitudes would match the overall adult opinion that computer users hold science-related careers.

With the rapid increase of computer use since the eighties, many more occupations today use computers for day to day operations. It is believed that parents' perception of the typical computer user matches that of students (Mason, 1994). Of concern is the statistically significant differences found at the secondary level. This research
shows the restricted view these students have in selecting fields dominated by computer use.

In particular, one finding of the survey was surprising. More students (55.1%) drew females using computers rather than males. This finding is encouraging since many articles claim computer usage to be a male domain. Previous research cited by Barba has shown that 87% of students would draw a male figure when asked to draw a scientist. Being that students are more likely to draw figures of their own gender, it would be interesting to know which gender was the majority of those surveyed.

Barba and Mason found a shift in the perception of computer users occurring between seventh and eighth grade. Although reasons for this are likely to be related to the various changes that occur during adolescent years, further research is needed to discount computer usage as being undesirable. Do these changes actually occur at a younger age? If so, does research show ways to help keep students' attitudes positive? A research study conducted in 1995 found that elementary children have preference in terms of program type and content of children's software (Nathan and Baron, 1995). With this knowledge, educational software
designers can build positive attitudes by creating programs students find interesting and motivating.

Nathan and Baron (1995) selected sixty-two children at the fourth grade level with mixed ethnicity. The researchers chose four age appropriate software programs. Word Attack Plus and Math Blaster Plus were the drill-and-practice type programs while Grammar Gremlins and Mr. Math were the tutorial type programs. The time in which this research took place was over a five-week period. Placed in groups of ten, children were given four twenty minute time blocks for each software program. During the last session, the children were asked which game they liked best and why.

The researchers found that there was no correlation between gender and program content and type (p<.05). This helps to confirm that a narrow gap in gender exists during the elementary years (Nathan and Boland, 1995). However, children preferred the drill-and-practice type software over the tutorial type (p<.01). Nathan and Baron claimed the students prefer drill-and-practice software since they do not require as much mental effort. Of the four programs, 72.6% of the 62 children chose Math Blaster Plus as being their favorite because it was exciting, most
interesting, and amusing. This program was later found to require the least amount of reading.

These results show that software should include features that maintain and attract students' attention while providing an appropriate level of educational value. Because of Math Blaster's gaming value, many students are unaware of the mathematics being taught. However, researcher John King has found some dangers in letting students think of the computer as a gaming device. In an article titled, "Fear or Frustration? Students' Attitudes Toward Computers and School" (1995), King examined factors which caused students' computer anxiety level to increase over an intensive nine month study.

Four seventh-grade classes were selected from a large metropolitan city in Australia. Each class was provided with twelve microcomputers in hopes to improve computer literacy before the students transfer to high school. Two of the classes were combined into a class of 63 students and two teachers. This class was labeled Class C. Classes A and B contained 31 and 34 students respectively and acted independently of one another. Students were given a computer-anxiety index (CAIN) test to determine their anxiety level during the first week of the
course. Several statistical operations were performed to determine the validity of the CAIN. King inserviced the four teachers on ways to evaluate their own anxieties and how they could lower students CAIN levels.

Near the end of the nine-month study, the computer anxiety index was given again to relate pre and post results. The results indicate a significant increase in the CAIN for all groups except for Class A. What caused the levels to increase so drastically? According to King, the teacher of Class A was the computer coordinator for the school and was a positive role model in terms of computer use. The teacher of Class B stated she was not entirely comfortable with the presence of the computer in terms of the noise and disruption they caused in direct-teaching activities. Due to lack of access, it is no wonder that these students showed the greatest increase in CAIN values. Because one of the two teachers of Class C left during the study, no conclusions were made for this class's performance. Of importance however, it was found that students with low CAIN scores, indicating a low anxiety level, saw the computer as a tool whereas the students with high CAIN scores viewed the computer as a gaming devise and
found it frustrating to remain motivated using tool type programs (King, 1995).

King's results indicate factors that contribute to computer anxiety. The author mentions students' view of the computer and its use, lack of access, and poor role models as factors. Lily Shashaani (1994) extends this list to family opinions and situations. The purpose for this study was to examine the effect that parents' socioeconomic status (SES) and sex-role stereotypes had on their children's attitudes toward computers. Using 1,730 students in the ninth and twelfth grades, Shashaani collected data on student demographics such as age, grade, sex, race, and family SES. Socioeconomic status was determined by using the parents' occupation and education level. Subjects were given a computer attitude survey consisting of 39 items which not only probed the students' level of anxiety, but also the students' perception of their parents' attitudes. Students were also asked if their parents encouraged or discouraged them to become involved in computing.

A multivariate analysis of variance (MANOVA) showed significant gender differences on computer interest, confidence, and stereotypes about computer users (p<.001).
In fact, males generally agreed that they had an interest in using computers and felt confidence in using computers. In terms of stereotypes, males showed no opinion with a mean score of 3 out of 5 on the Likert type test. The female response was just the opposite with a no opinion response to interest and confidence and a strongly agree opinion of 4.6 out of 5 that stereotypes do exist.

Parental influence was found to be negative in low SES families and positive in high SES families (Shashaani, 1994). This is most likely due to the level of access to a computer. In this study, parental encouragement had the greatest effect on gender stereotypes, then the attitudes of parents, and the least effect was the SES of the family.

Shashaani found one disturbing result. When the fathers’ SES was high, both sons and daughters had positive attitudes toward computing and were more in favor of sex equality for computer use. However, when SES was measured by mothers’ occupation and education, high SES contributed positively to their daughters’ computer attitudes, but not to their sons’ (Shashaani, 1994). Research in the field of adolescent psychology might answer why this is so.

From these articles, it is clear that gender differences begin to occur during middle school. The
adolescent years are very crucial in determining students' future career choices. Students at this level are generally allowed to choose which courses they wish to take. Many females choose a path toward a career requiring limited mathematics, science and technology skills (Farmer, 1998). This of course leads to the gender inequalities found in today's' work force.

According to a study conducted by Helen Farmer (1998), it was found that men were 18.7 times more likely to have a higher prestigious job in using technology than females. Originally 459 students participated in this study during high school. Several years later when the participants were 22-28 years of age, a subset of 173 participants was formed by only choosing those whose career involved math, science, or technology. Using this subsample of the original 459 participants, the researchers compared the level of prestige associated with the position and the courses individuals took while in high school. Prestige of a career was calculated by computing the educational level, earnings, and power of a position. When the study matched females with males, the findings indicated that equally prepared women chose less prestigious careers than the ones men chose. This study suggests that females have a
Drastically lower level of confidence in math, science and technology (Farmer, 1998).

In the next collection of reviews, a connection is made between the success in math and that with technology. Further it supports the idea that the more technology one uses in the curriculum, the more he or she will be encouraged in mathematics. This increased comfort level with the subject matter will help improve confidence in and satisfaction towards mathematics.

Interaction time within a class can influence a person’s attitude and satisfaction of a course (Zhang, 1994). Being that technology use in the classroom helps drive alternative teaching and learning methods, Zhang’s findings shows how technology can help relieve tension found in the mathematics classroom. It helps to show that if we can increase computer use and access for girls, we can empower them to withstand the societal pressures.

The purpose of Zhang’s study was to determine if the levels of interaction equated with psychological interactivity. The study focused on student attitude and satisfaction, personal participation, perceived level of interaction, and observed participatory behaviors of other class members. Questions were designed for each of these
variables and were examined by using the mean of the responses.

Connected through the Hawaii Interactive Television System, the survey used 260 K-6 teachers enrolled in a ten-session course taught in five different rooms on four islands in Hawaii. The sessions were 75 minutes long with a minimum of two weeks between each session. The education course was taught by three education professors at a studio that was connected to the remote sites through the use of video, audio and fax technologies. No students were present at the studio.

At the end of each session, the students were asked to complete a questionnaire developed by the researchers that focused on learner-instructor and learner-learner types of interaction. Divided into non-instructional and instructional time, three judges determined interaction during each session. With a low correlation of 0.18 (df=8, p=0.62), the study found that there was no significance between perceived interaction time and actual interaction time. Therefore, the authors could not conclude that a relationship existed between student attitudes and the actual amount of time spent on interacting with others. With r=0.27 and a probability of significance of almost one
half, the overall satisfaction was not significantly correlated with the overall interaction time. The authors did however find that student attitudes and the perceived amount of interaction time to be highly correlated with $r=0.98$ (df=8, $p<.01$). As the perceived amount of time interacting increased, the students' level of satisfaction with the session increased proportionately (Zhang, 1994). The perceived level of in-class interaction accounted for 88% of the variance in overall satisfaction.

In conclusion, the results indicate that as the perceived level of interaction increases, satisfaction and attitude toward the class also increases. These findings imply that interaction between students can increase their overall opinion of a course. Teachers using technology as an instructional tool encourage more interactions among their students. With a call from the NCTM standards for alternative assessments, teachers are searching for more uses of technology than ever before. Technology is being used in the classroom to increase understanding and satisfaction through collaboration on group projects (Pollina, 1995). But does technology use affect a student's perception of mathematics? Shashaani's (1995)
research has found a positive correlation that helps to answer this question.

Shashaani's purpose for her study was twofold. First, she examined differences between male and female experiences in and attitudes toward mathematics, and secondly, related these differences to the attitudes toward computer science among high school students. The survey used 1730 students, 902 boys and 828 girls in grades 9 and 12 from five predominantly white schools in Pittsburgh, Pennsylvania. The subjects came from different socioeconomic backgrounds and various geographical areas. The subjects from the 9th grade totaled 52% of the survey and the ages ranged from 13 to 19.

Questionnaires were given to obtain a mathematical background of each subject and the attitudes toward mathematics to include liking of, confidence in, and stereotypes about mathematics. A five-point scale was used for each question. A scale from previous research was used to measure the subjects' attitudes toward computers to include liking of, confidence in, and stereotypes about computers.

The analysis of the findings was derived by various statistical techniques. The Chi-square Test was utilized
to determine a substantial gender difference in terms of
the number of mathematics courses taken for both ninth
(p<=.02) and twelfth grades (p<=.005) (Shashaani, 1995).
In both grades, males had taken more mathematics classes
than female students. It was also determined that males
liked mathematics more than females, and males liked using
computers more than females. In addition, it was
determined that girls had a lower math confidence than
boys, and that girls were less confident in using computers
than boys. The findings in this study are reported in the
chart below. They indicate math and computer use to be
highly correlated.

Table 1. Math/Technology Relationships

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<tr>
<td>Math Liking</td>
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<tr>
<td>Computer Liking</td>
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<tr>
<td>Math Confidence</td>
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<td>Comp Confidence</td>
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![Math/Technology Relationships Chart]

Males | Females
Positive and significant Pearson correlations existed between the set relationships found in mathematics and computer attitudes. Computer interest and math liking were positively correlated \( r(\text{male}) = .30 \) and \( r(\text{female}) = .28 \) at \( p \leq .01 \), and confidence for each were positively correlated \( r(\text{male}) = .36 \), and \( r(\text{female}) = .35 \) at \( p \leq .01 \). This finding indicates that the feelings one has towards technology are highly related to their opinions of mathematics (Shashaani, 1995). Neither males nor females viewed math as having a male dominance but did however disagree with sex-equality in computer use \( X(\text{males}) = 3.0 \) and \( X(\text{females}) = 4.6 \). Even though no significance was found in regards to attitudes of math and computer science as being a male domain, previous research conducted by Shashaani (1993) indicates many gender specific differences. In an article titled "Gender-Based Differences in Attitudes Towards Computers", Shashaani (1993) focused on the attitudes high school students had towards computers. The author also wanted to see how gender affected these attitudes.

Using 1754 students from five suburban public high schools in Pittsburgh, Pennsylvania, subjects were surveyed in five areas. These included interest in computers, stereotypes about computer users, concept of computers,
confidence in ability to use computers, and students' perception of their parents' and teachers' attitude toward computers. The survey used a 5-point Likert scale with 1 indicating an opinion of strongly disagree to a 5 indicating an opinion of strongly agree. The students were given ample time to complete the anonymous test in their English and Social Studies classes.

Mean, standard deviation, and Pearson correlations were calculated among related variables to observe whether significant gender differences occurred. In terms of computer interest, boys showed more of a willingness to learn and were much more excited about computers than girls (p<0.0001). With respect to self-confidence, girls feared using computers, felt helpless around computers, and computers made them uncomfortable and nervous (p<0.0001). Even with these results, girls held a strong belief in the equality of both sexes for participating in computer activities (X=2.9 for boys and X=4.6 for girls). Girls also felt that given a little time and training they could learn to use computers (X=4.1 for females) (Shashaani, 1993).

In particular, one statement on the survey interests me in this study. Female students disagreed with
the statement, "My parents and school counselor encourages me to take more math and/or computer related courses". With a strong significance, males received more support from adults than females (p<0.0001) (Shashaani, 1993). While Shashaani's studies focused on gender differences in terms of experiences in and attitudes toward mathematics and how these attitudes affected the attitudes toward computer science, Waxman's (1996) focus was to determine whether an increase in the use of technology directly affected students' perception of mathematics. In addition, Waxman wanted to see if differences in three categories occurred in various grade levels using the same level of interaction. The categories included Learning Environment, Motivation, and Mathematics Anxiety.

Conducted in a school district known for its availability of technology for the classrooms, the study randomly chose 1,955 sixth-grade and 1,940 eighth-grade, multiethnic students. Each student was allowed fifty minutes to complete several surveys that assessed their perception of the course on seven scales (math anxiety, achievement, motivation, academic self-concept, parent involvement, satisfaction, affiliation, and involvement). Each item was measured on a four point, Likert-type scale
where an entry of one meant the item never occurred in the student's classroom and a 4 indicated the student felt the item occurred regularly. In order to determine the degree of technology used in the classroom, the researchers recorded the percentage of time technology was used in the classroom. They found this percentage by observing six randomly selected students from each class for ten 30 second intervals. The results indicated about 31% of the classes observed had a moderate use, 28% had a slight use, and 41% had little or no use of technology (Waxman, 1996).

A multivariate analysis of variance indicated significance for the student's grade and level of technology used (p<.001). With the eighth-grade, it was found students in classrooms where technology was moderately used had significantly lower math anxiety and higher satisfaction. However, it was found that sixth-grade students had similar results only when technology was slightly used.

These results indicate a significantly greater comfort level with technology in the higher grades (Waxman, 1996). A reason for this might be that eighth-graders find technology more useful for their higher level of mathematics. With this in mind, elementary teachers should
have their students use technology for class discussions, projects, interactive programs, and connections with other schools. Students associating computer use with their studies at an early age will find more of a connection with a higher level of math and science found in secondary education.

A connection needs to be made between a student's attitude towards mathematics (ATM) and their achievement in mathematics (AIM). Should it follow that if one has a positive attitude about math that he or she will find improved success? In a research study by Xin Ma and Nand Kishor (1997), such a relationship was found.

Conducting a meta-analysis, the researchers reviewed the results of tests given to 82,941 students in several different studies. Looking at the overall effect of the relationship between ATM and AIM, the authors found the relationship to be positive and reliable, but not strong. However, when the researchers grouped the tests in terms of grade level, significant differences between grade levels occurred (p<0.01). A table on page 36 of the article shows the relationship decreasing as students move up through the grade levels. The ATM-AIM relationship for elementary students in grades 1-4 was strengthened by 367%
in comparison to secondary students. These findings indicate that a positive attitude toward mathematics is highly correlated to success in mathematics for all grade levels and significantly strong in the primary classroom (Ma and Kishor, 1997).

These studies support that gender differences in mathematics and technology exist. Indicating that these differences begin to show in middle school, the studies have found that anxiety levels and satisfaction in mathematics to be highly correlated with technology use. Research goes further to indicate that integrating technology interaction into the curriculum will improve attitudes toward courses in technology. It logically follows that as instructors provide more technology interaction in their daily instruction, the less we will see gender differences occur in mathematics.

Overcoming Gender Differences

Research supports the increased use of technology as a means to diminish the anxieties one feels while using technology (Zhang, 1994), (Shashaani, 1993), (Waxman, 1996). It has also been found that with a high level of correlation between attitudes and achievement in mathematics and technology, diminishing the anxieties in
one affects the other. It follows that the more we integrate technology throughout the curriculum the greater the chance will be to motivate females and males alike to pursue these male dominated fields. The following research suggests ways to use technology throughout the curriculum to improve attitudes and lesson anxieties.

Laurie Edwards (1994) gives an example of how the program Logo is being used in a cooperative setting to improve exploration and understanding. The purpose of the study was to test a Logo-based environment that Edwards created for mathematical studies. In addition, the author was interested in seeing how children worked together to gain a better understanding of the microworld (a particular investigation created in Logo).

The study used 34 sixth-grade students of which sixteen were boys. The study took place in a poor neighborhood of the capital city of Costa Rica in one 80-minute afternoon session. The students had been using the provided technology for the past five years so neither the Logo program nor the computer use were new to them.

The first 10 minutes of the session was spent introducing the activity and passing out data sheets. For each experiment, students were asked to record the various
two digit numbers they tried and what they found out. At the bottom of this data sheet, students gave an hypothesis, based on their experiments, of how the program worked. For 35 minutes, students worked with a partner to complete the data sheets using the created Logo microworld (program). After producing an hypothesis for the patterns created in the microworld, each pair described to the group how they thought their various inputs of two digit numbers related to the inscribed figures displayed on the computer. Students were then given a second chance to alter their hypotheses using a second worksheet that specifically focused on the function of each input to its output.

Almost all of the students (82%) were able to determine the function of the first digit input to the procedure. This gave the number of equidistant points set around the circle. Even though the majority of the pairs knew that the second number entered had something to do with the shape of the figure inscribed, the author found that one pair (6%) was able to determine the precise function of the second digit input to the procedure. After the successful pair demonstrated their findings to the group, 76% of students were able to accurately describe this relationship in writing (Edwards, 1994).
The author concluded that while not all of the students could initially understand the microworld, by the end of the session the students were able to use the procedure gained through collaboration to produce various figures (Edwards, 1994). This research also helps to show that although collaboration takes more time than traditional instruction, students explore more in depth and absorb more information into long term memory.

Like Edward’s study, Drew Tiene and Evonne Whitmore (1995) published an article on how schools are using the technology available to them to improve students' success. The purpose of the study was to determine if schools subscribing to the Channel One newscast were using the technology provided for other school uses. The focus of the study was to see if the exchange of having the free technology for school use would outweigh the undesirable daily requirements of viewing the Channel One newscast with its corporate advertising commercials. The authors also tried to generalize the television environment of American schools.

Tiene and Whitmore developed a survey that was mailed to randomly selected Midwest schools that subscribed to Channel One. A sufficient sample size of 154 returned
the surveys of which 51% came from high schools, 32% came from junior high schools and the remaining 17% came from schools with grades 7-12. Of those who filled out the survey, 48% were administrators and 39% were media specialists or librarians. The majority of the schools surveyed had subscribed to Channel One for several years. The questions were set up on a 1 to 5 scale where a 1 represented a response of "strongly agree", 3 "neutral", and 5 "strongly disagree".

The survey asked several questions including how often was the technology utilized in the classroom outside of the required daily viewing. A reasonably significant level (52%) of the respondents claimed to have used the technology more than four times per week (Tiene and Whitmore, 1995). Approximately two-fifths of the schools indicated that the system of televisions and video cassette recorders linked to a head end unit was being used for school activities, announcements, and purposes other than viewing television broadcasts. While only 12 to 14% of the schools used the system for lectures and parent meetings, 45% indicated that student productions were shown over the system and 67% used the system for special programs. Over 92% of the schools indicated that the system was easy to
use and had few operation problems. When asked again
towards the end of the survey if the schools were using the
television network for announcements on a regular basis,
48% agreed that this was true which was consistent with the
percentages (41% and 42%) indicated earlier.

Although most of those surveyed thought the system
had more potential, the study proved it was being used for
purposes other than just viewing broadcasts (Tiene and
Whitmore, 1995). The authors concluded that the Channel
One package was a great source of information and equipment
for any school. With Channel One offering free technology,
students will have the opportunity to use newer technology
thus reducing future anxieties when using this hardware in
the secondary classroom.

The use of electronic resources and telecommunications
is on the increase in schools worldwide. Students are
exchanging ideas on global issues with other students both
intranationally and internationally. This article mentions
several situations where students are making these
connections in the k-12 classroom.

In one situation, students at Manhattan High School
in Manhattan, Kansas showed their skills of using the
Internet, television, and news stories like XPress XChange
delivered over cable TV to research the actions and leadership of the United Nations (Arli, 1996). Students used Super Link and Power Point to create multimedia presentations for their classmates, parents, and for students at other schools. In another situation, students in West Lafayette, Indiana launched a school to school pen-pal program with a school in Tanzania. These students word-processed 500 letters asking for donations to buy books and computer hardware to aid their sister school. From email to two way distance learning over satellite, the article goes on to give examples of students using telecommunications in the classroom. The author gives a list of school web pages that promote this type of interaction.

An increase in the use of technology brings about alternative teaching methods and assessments thus bringing about more interaction within a cooperative setting. Hopefully, as we see more and more technology being used in the primary classrooms, we will find less anxiety in the secondary mathematics classroom. The April 1995 issue of the Technology Teacher featured an interesting article on the use of technology in the classroom. The authors, Alan Olds and Richard Lightner, presented their school as making
great progress toward becoming a mirror of the professional workplace. How the courses came about and how they have engaged the students’ interest provides a model for other schools wanting to prepare students with technological and workplace skills.

In the 80’s, teachers at Alvada West High School in Colorado began wondering about the students who graduated but never went on to pursue degrees. Stories from the community led to the belief that those students, who totaled more than eighty percent of the graduating class, were not prepared for the technical world given their traditional education. Students were taught knowledge independently while employers searched for technological literate students who could work cooperatively. Dick Lightner, co-author and electronics teacher, was asked to select and purchase equipment for a new high school. With these funds, Lightner hoped his efforts would guide him in designing an updated curriculum. The article continues to outline his design.

The first course to be offered to vocational students was an engineering practices introductory course sequence. By request of the industry, engineering students were taught how to work cooperatively and communicate
effectively on real-life problems that combined a variety of traditional subjects (Olds and Lightner, 1995). Local businesses and companies used many of the suggestions offered by these students. This success led to new course offerings allowing students to encounter workplace problems in other subjects as well as engineering at the high school.

Within the high school setting, students of the class were given the project of redesigning the metal shop to meet the needs of the composition/technology class. With the school board approval of funds, students followed the project from beginning to end by providing twelve computer work stations with VCRs, six printers, and equipment for applied physics courses. Indirect lighting, plants, and gray carpet were added to give the room a real life business look. Students gave reports, researched businesses for materials, and contracted the labor to have the room ready for the beginning of the following year. When the teachers announced on the first day of school that students would be taught skills to solve real-life technical problems, the classroom itself provided the validation necessary to make that statement convincing. The overall project of becoming a school of today is still
continuing. New classes are being added and local businesses are funding the bulk of the project.

Another project to make the course as real life as possible was to give students the job of converting lab manuals between two versions of a program (Olds and Lightner, 1995). The job, usually done by teachers of the course, was given to students who knew very little about computers and their functions. Students used the computers, LED tablets, CD-ROM databases, electronic trainers, e-mail, and fax machines. Contacts were made with professionals in environmental technology fields which empowered students to work well on projects they perceived as having an impact on their school and themselves.

For every project the students evaluated themselves, group members, and the project itself. Teacher evaluations were kept to a minimum in hopes that students would take ownership of the class and what they were learning (Olds and Lightner, 1995). The teachers kept the curriculum flexible and coached the students as they learned the function of technology in solving a problem. Subject matter, technology, assessment, and practically everything else was integrated so that the classroom felt more like the demanding interdisciplinary workplace.
This motivational article relates to the challenges faced in creating a high school web site. According to the article, three important elements are needed to bring about a technologically advanced school. First of all, teachers must be willing to take the time to overcome their fears of using technology in the classroom. Inservicing, mentor teachers, community businesses, and even our students can help provide us a sense of security and understanding. Probably the toughest adjustment for teachers is to let go of the structure found in textbooks and accept the vast knowledge found on the Web. The next important factor is money. Initial dollars are needed to fund the beginning of a technological change within a school (Olds and Lightner, 1995). Money might be available through grants or in restructuring funds. As a means to overcome teacher phobias, stipends should also be provided to motivate involvement in technology endeavors.

As long as a faculty is willing to move from a traditional setting to one that matches the real workplace, a program like this provides an outstanding example of the steps needed to take in order for a smooth transition. Within the last few months, I have become more aware of the money that is available for technological changes like
this. Not just funds from various governments, but local
businesses and large corporations support schools with
professional support on funded projects in the classroom.
At our high school, we see the need to bring technology
into the classroom. In the coming year, our Digital High
School funds come due and a plan is in place to make life
changing strides in our technology infused curriculum.

Staff Development

Staff Development is a key component to any well-run
school district. Educators come together to share and
explore new ideas to help become in tune with students'
needs. But what are the students’ needs? No one can deny
that as our graduates merge into the workforce, they will
be expected to use, or at least be exposed to, a variety of
technological resources. It is thus the schools’
responsibility to prepare its student body for this
transition. It is unfortunate that many schools are not
meeting this need and are failing to provide students with
an adequate foundation in using technology. However,
without appropriate training one cannot expect teachers to
integrate computer use into their courses. The literature
I have selected here gives a structure to providing
effective staff development in using technology.
Through research conducted by Educational Turnkey Systems, approximately three hundred million in state funds and four hundred, thirty million federal dollars were spent on staff development in education in 1998 (Fletcher, 1998). These astronomical figures can help us realize the commitment educators have in continuing their education to improve their effectiveness with children. With technology use becoming a priority in education, many of these staff days will focus on training teachers on how to use their school’s network, computers, and software. As ineffective as this may appear, an understanding of how the technology works is an important first step of technology inservicing. However, according to the California Department of Education’s K-12 Network Technology Planning Guide (1995), the focus should be on how technology will be used, not just how to use it. This is best accomplished if districts provide the staff with one who is educated in using technology in the classroom.

If it is true that educators teach the way they were taught, many staff development providers are actually doing a disservice by not using technology to model or demonstrate how it can be used to achieve curriculum objectives. In an article titled, “Training-On-Demand: A
Model for Technology Staff Development”, Enola Boyd (1997) claims that hiring a curriculum director whose background is in instructional technology, and staff input following development day are two key factors that contribute to successful training. The curriculum director in many schools is simply a dedicated teacher who is technologically inclined. While this may be fine at first, once technology becomes fully integrated into the school, districts should hire part- and full-time personnel whose sole responsibility is to train others. Although this person may have other responsibilities, he/she should be able to drop whatever they are doing to assist staff when requested. The second key component, input from the staff, can be used to evaluate the program in order to modify or tailor it to meet the current needs (Boyd, 1997). Author Rena Cirareli (1998) states that staff input is needed for the basis of the training. The author gives a framework of the steps needed to begin staff development in technology and a unique example of how the entire school’s community can benefit from it. 

In order to offer an appropriate level of training, a questionnaire should be used to determine a site’s level in using technology. One should survey their staff before
beginning staff development on technology each year (Cirareli, 1998). The instrument can be used to evaluate the progress that has been made during the previous year. Such a survey is offered in the May 1998 issue of Learning and Leading with Technology. This study was broken down into three categories. The questions numbered one through twelve determine ones writing and communication skills, questions eighteen through 38 gauge ones knowledge of management and information access, and questions thirty-nine through forty-six assess ones productivity level and understanding of the effects of integrating technology. With quality control questions added into the survey, the one who analyzes the results can validate staff responses. Since the questions are listed form simple to complex, the higher scores imply that more technology has been integrated into the classroom. The surveyor can also use a spreadsheet program to analyze the site’s responses. Broken down into the three areas, a graphical representation of the results can quickly be read by administrators to determine areas of need. Whole group instruction will then be customized to meet the needs of the group and activities will thus be appropriate.
Small group instruction is necessary to meet the needs of individuals. Staff members should be allowed the freedom to roam between groups in order to make the most out of their technology day. These focus groups should always include a wide range of topics from simple to complex applications. The instructors can be technology proficient educators and other support staff. The authors of the California Department of Education K-12 Network Technology Planning Guide claim, "Only a well trained, confident (support) staff can effectively train and support others" (1995). While this is true, it is important to offer hands-on technical training for those who head the small focus groups.

Authoring Systems

Authoring systems are becoming widely available to the educational market. Designers are creating programs with features that are not only user friendly, but also applicable to education. Without programming knowledge, these high level programs allow students and teachers to create multimedia software that was once left up to professional software designers (Vaughan, 1996). With more computers being placed in our schools today, the curriculum
can include technology to increase student performance and teacher productivity.

Since most authoring programs have the ability to be converted to web pages, it necessary to obtain a better understanding of the types of authoring tools. Being responsible for holding web page staff development courses, I wanted to be able to provide assistance to individuals requesting training in developing and importing authoring programs into their web pages. This knowledge will keep me ahead of the staff at my school keeping the confidence I have as the high school web master. The goal of this project was to increase student interaction with a computer by motivating teachers to provide educationally worthy sites for their students. This section of this project will first define authoring systems, and then discuss the literature that supports authoring systems as an educational tool.

There are four types of multimedia authoring tools when one groups them by how the elements are organized or sequenced (Vaughan, 1996). They include card- or page-based, icon-based, time-based, and object-oriented. When the elements of the program are arranged as cards of a stack or pages of a book the authoring tool is page- or
card-based. HyperCard, HyperStudio, and web-based programs are examples of this type of authoring system. Authorware, Quest, and Digital Chisel are examples of icon-based programs where icons are used to set up the structure of the program being created (Vaughan, 1996). This flowchart gives the creator a path view of how each item connects. Elements of the program can then be added and the icons can be edited for fine tuning the completed project. Unlike card-based authoring systems, icon-based programs give the developer the "Big Picture" of the project (Vaughan, 1996).

Macromedia Director is a time-based authoring tool. Similar to the structure of icon-based software, "time-based programs organize events and elements along a timeline to create media-rich interactive products" (Kristof & Satran, 1995). Teachers who have developed educational software would find this type of program to be less restricting. However, with such a steep learning curve, one should see that staff and students would opt to use card- or icon-based tools for their projects. In the last category, object-oriented authoring arranges multimedia elements and events without timelines or stacks of cards. Objects include animations, video, text, sound, and images with assigned properties that send commands or
messages to one another. Used more for gaming, programs of this type like Apple Media Tool, MediaForge, and mTropolis are not used often for student or teacher projects (Kristof & Satran, 1995).

When selecting an authoring program, one should keep in mind how it is going to be used and who is going to use it. In creating software, there are several features to consider when selecting an authoring system. Many of which apply today, John Phillipo (1989) identifies several features to consider. For educational purposes, testing templates and student management seem to be the most important features. One of the criteria when evaluating educational software is whether or not the program has a management system (Phillipo, 1989). Teachers need to be able to justify a student's time while working on a program and can do so using a built-in management system to assess the learning and to record performance. For creating software, the program should be at the appropriate level for the user. Programs like Digital Chisel include several levels at which to create in. Other things to consider are ease of use, menu options, cross platform abilities, html converters, and the price.
Where dollars come second to image, many businesses today are using the latest and greatest authoring programs to create presentations and interactive training programs. Southwestern Bell uses a VR training course built with Superscape's authoring tools (Rodriguez, 1996). The course teaches field technicians how to install a telephone system in customer sites. Previously, this company had to fly new employees to their regional office. Now they can train at home thus saving the corporation thousands of dollars.

Authoring tools use for educating seems endless. Many examples can be found in the literature that exists on the subject. Instructors can use these tools to create custom lessons that present information in an understandable yet engaging way. Edward Mobley (1996) presents a music instructor's ability to create a HyperCard program that motivates his students to learn music theory in a hypermedia atmosphere. The instructor, Don Doucette, hopes that his interactive programs "will be more effective in communicating with a generation of students weaned on highly visual media such as television and video games" (Mobely, 1996). Doucette chose the HyperCard program for its support of the CD-ROM format. With Voyager CD Audio Toolkit and HyperCard, Doucette creates programs containing
music samples combine with program notes. When students choose a button from the menu selection, the button reacts by playing a piece of work off a CD and display text related to the topic defined by the button. Doucette uses his software as a presentation tool to teach a college-level music appreciation class.

Royal Van Horn (1996) shares some of his difficulties of authoring a first-grade project in an article titled, "Making Multimedia, Part 1 and 2". The author first claims that developers should look deeply into copyright issues. With a possibility that any quality program might be publishable, Van Horn warns developers of software to create original work or have written permission to use others work in their programs. Secondly, Van Horn suggests one to look at basic design feature of the authoring tool being used. These included screen size for videos verses memory requirements, number of colors supported, Internet capabilities, and the ability to have the software be cross-platform. Van Horn claims that the organization of the project is necessary for quality multimedia projects.

Several articles show how students are using authoring tools to create projects and increase productivity. Besides prompting cooperative learning, critical thinking,
reflection, and analysis, authoring tools "help students think about thinking" (D'Ignazio, 1992). The finished project is only part of the final outcome. James Higgins (1991) in an article titled, "The Technological Evolution in Schools", claims that creating and using authoring programs in itself promotes learning since the learner needs to find information and organize it before incorporating it into the program. The finished product gives the learner a great sense of accomplishment which increases ones self esteem thus driving one to learn more.

Dr. Edward Mills (1997) shared an example of a student using an authoring program to create a personal portfolio in his class. Requiring portfolios from students for the past three years, Mills was handed a zip disk as an alternative to the traditional folder type portfolio. With excitement, the author quickly went to the school's computer lab only to find out that the lab had no zip drives. After hunting around the campus Mills finally found one but the program was created with a Macintosh and the school only had IBM compatibles. He finally got his hands on a Mac but then found that some of the software used to create the portfolio was not on the computer. After purchasing the required programs and jumping through
all the hoops, Mills was finally able to view his student's work filled with impressive video and audio files along with the traditional text of personal improvements and success.

Conclusion

Compatibility and availability of hardware and software can keep teachers from authoring software. My personal example is similar to Mill's. One of my students handed in an interactive project that I could not view with my school's Macintosh computers. With the knowledge I have gained, I asked him to save his file in html. The following day, I uploaded his program and shared it with the class via the Internet. From this experience, I now request project files to be in html.

The goal of this project was to create a high school web site that will allow teachers a place where they can post lessons and other educationally related pages. Intended for interaction, these pages would motivate students to interact with technology on a regular basis. The literature I have reviewed covers areas related to creating such a site. Studies on gender inequalities and stereotypes helped to provide a reason for tackling this problem. Providing a necessary connection, studies have
indicated that relationships exist between mathematics and
technology. It has been shown that ones attitude and
satisfaction with technology highly correlates to ones
attitude and satisfaction with mathematics. This
literature also suggests that the more one uses technology,
the less anxieties one feels toward technology. Without
this connection, efforts to lesson the gender gap would
have been restricted to my classroom. Providing this
technology option across the curriculum has allowed me to
make a greater impact.

With an increased level of knowledge gained from this
review, I was able to provide staff development courses
that met the needs of individuals and lessoned the phobias
found when learning new programs. Reviewing the related
literature had helped me to develop the appropriate type of
inservicing for those wishing to develop web pages. I have
provided small group and one-to-one instruction. I have
trained others to a point where they can hold small group
introductory courses. This atmosphere has given me a
chance to address the needs of others on an individual
basis. The reviews on authoring tools allowed me to give
an experienced opinion to those wishing to have a more
interactive site. As a cohesive group, my review of the
related literature had focused my attention on a project that helps to diminish anxieties felt by females in mathematics courses.
Chapter Three:

Statement of Objective

Project Goal

Research has shown that when females enter high school they begin to show a lack of interest in technology, science, and mathematics classes (Sadker, 1999). Being a high school mathematics instructor and technologist, I felt a calling to find a way to help motivate females to pursue these fields. Research uniformly suggests that an increased use of technology will help to lesson the pressures felt by female students in male dominated courses such as mathematics (Boland, 1995). Research studies have given me many suggestions to alleviate this problem, but I felt a web site would make the most impact across the curriculum.

The goal of this project was to inservice teachers on how to create educationally worthy web pages that would motivate students to make regular use of the technology around them. Studies have shown that fewer gender differences exist as more students spend time learning with computers (Kirkpatrick, 1998). Increasing technology use in the curriculum will statistically improve achievement in mathematics (Waxman, 1996, & Shashanni 1993). These direct
relationships confirm that a high school web site can be a
global area for students to interact with technology on a
regular basis. To meet this goal, I created a high school
web site and evaluated its effectiveness by surveying
teachers who had created classroom web pages. In the end,
by encouraging females to interact more with technology
through this new medium, this project has provided a way to
help close this gender gap giving females an equal
opportunity to succeed in mathematics.

**Project Objective**

The objective of this project was to design and create
a high school web site that encourages students to interact
with technology on a regular basis. During the four years
of high school and beyond, this interaction with technology
will help close the gap between genders. It has allowed
females the opportunity to view and interact with the site
at home or through other chosen environments. This freedom
of choice allows one to remove themselves from the
pressures of society allowing them to focus on the task at
hand. Supported by previous statistical studies, this
interaction has helped to encourage females to pursue
technology and mathematics fields with satisfaction and
enthusiasm.
In order to meet this objective, it was my intention to motivate teachers to utilize the site I had created to add educationally worthy material that students would interact with. These sites included information about individual classes or subjects, current topics that had been discussed in class, links to sites containing educationally worthy material, student expectations, current class grades, class notes and suggestions, email links to communicate with instructors, and writing prompts that were submitted via the Internet. With this endless list, this project provided a place for students, teachers, and the community to converge making meaningful connections within and without the site. To test this result, I surveyed instructors on various ways their site interacted with the student population. Further, I used previous research I conducted to indicate ways to diminish the gender gap found currently in mathematics.

As educators, we often start a project from ground zero reinventing the wheel for the betterment of children. It is hoped that this site would not only meet the needs of the community, but would also serve as a template or guideline for creating an educationally worthy web site. To accomplish this task, the web site was registered with many
of the top search engines. I hope others would find the site to be worthy of such an honor. Although the completion of the site goes well beyond the scope of this project, it was intended that the growth of such will be exponential.
Purpose of the Project

The development of this project stems from many originating points beginning back in June 1999. During an end of the year interview with my school's principal, I was prompted to begin thoughts of creating a high school website. Being known as one pursuing a degree in educational technology, the principal thought I would be a likely candidate for such a challenge. Knowing the complexity of creating such a site, I nodded as if to say let me think about it.

I felt the challenge at hand upon my return in August. Over our six-week summer break, I realized that a high school website would meet one of the recommendations proposed by many of the studies I had read throughout my education of instructional technology. The recommendation was that an increased use of technology brings about higher levels of satisfaction towards and achievement in the use of technology and lessons the anxieties towards the course. Further, a high level of correlation was found between the findings of technology and that of mathematics. It gave the creation of the site a purpose that before did not
exist. With this new motivation, I began the steps toward creating a site that would help motivate females to seek and achieve in courses of mathematics, science, and technology.

Design

In order to meet the needs of all that would use this site, it was crucial before beginning this task to survey those involved. I wanted to survey students, parents, certificated and classified staff, and the school's administration. The first group to be surveyed was parents. I felt the best way to accomplish this task was during our Back to School Night in August. Traditionally, it is a time I see at least half of my students' parents and a time in the school year when most are optimistic about education. Given only fifteen minutes per class allowed me just enough time to briefly introduce myself, my policies, and discuss course objectives. During the last few minutes I set aside for each class, I informed those in attendance of my desire to create a high school web site. I asked for suggestions and creative ideas that they felt would best meet the needs of families. What came from that evening was a list of ideas I later used to survey the student body.
Students' opinions came through a formal survey administered in late August 1999. It asked students to indicate whether or not they felt the ideas for the site would assist them. The list included the option of placing the following links online: school calendar, an area to retrieve homework, project due dates, school activities, athletic schedules and standings, subject area links, individual teacher sites, college registration and scholarship due dates, library links, deadlines for school events, alumni information, and general information about the school. Included on the survey was an area for students to give their own suggestions.

The feedback from the Associated Student Body proved to be valuable. Most students were in favor of having a school calendar to include the athletic schedules. Other ideas that topped the list were homework areas, college information, and an area to retrieve homework. Two useful ideas came in the form of a written response. One student suggested that we provide email links to instructors and two students thought it would be helpful if they could monitor their grades through the site. Armed with this information, I began to survey staff.
All staff was given the results of both the student and parent surveys in the form of a list of items to be placed on the high school web site. Certificated staff members were given the survey results in print later to be discussed during an after school staff meeting. During this time, classified staff members were given the opportunity to discuss the results and give input. This group agreed with the survey results and requested that the cafeteria’s menu options be posted for children who have allergies to foods. The school’s administration had several ideas. Their ideas included links to our behavioral and attendance policies, an area for the counselors, reunion information, a page for commonly asked questions, and information about various tests. They also felt that posting grades could create security issues and wished this option to be omitted.

During our first staff meeting in September, teachers gave their input into what they felt would assist students in their educational endeavors. This group felt that posting homework on the web would be a tedious process that could do more damage than good without a 100% buy-in. It was further agreed to have email links to instructors, but that each instructor could choose whether or not to have a
classroom web site. With the grade posting option being omitted, the staff agreed to all of the presented ideas including an area for the alumni of the school.

Within a couple of weeks the site grew exponentially. I was faced with the challenge to create a site that met the needs of the community at large. Knowing the complexity of creating such a large site, I decided to begin evaluating software for the purpose of creating this site. Using the software evaluation form found in APPENDIX B, I chose the web authoring program Claris Home Page for its various page views, cross platform ability, overall functionality, and cost. With the expectation that students would create projects using the program, the selling point was how easy it was to learn. Having authored pages in the past, I found the Claris Home Page program to be a hands down alternative to writing html code line for line. On the management side, the program offers at least 95% of the features and tools a web designer/manager uses to maintain a site. A license for 15 computers and support materials were purchased through a School to Career grant known as Horizons. With these fifteen copies, I was able to make the software available to all whom desired to make a personal site for their classroom.
Authoring the Web Site

Before the arrival of the software in late September, I spent many hours creating the first draft. I began by compiling the data received from the surveys. I found that generally all groups agreed on what should be included in the site. I also took into deep consideration those areas that would motivate students to connect with the site on a regular basis. Each main page link was mapped out to its end in order to ensure ease of navigation. I chose to make the frame-based main page to make the transitions to subsequent pages smooth. When the software arrived, I had a plan that proved to be very helpful.

The three frames on the main page were used to make navigating the site easier. For browsers that do not support frames, I created a non-frame page that would automatically load upon detection. The top horizontal frame contained the school’s title and a link to our NBC Weathernet site. Using Gif Builder, a free animation program on the web, I created a four-scene title. Each scene gives the viewer general information about the school. The bottom frame was divided vertically creating a left and right frame. The left frame was reserved for schoolwide links and the right frame contained our school’s
vision statement. It was intended that when users clicked a link in the left frame the only change that would occur would take place in the right known as the target frame. This gave viewers the sense of a unifying theme. When pages grew larger than the frame allowed, links were added on these pages to allow the user to open the page up in a new browser. This process kept the main page open and accessible.

The first set of three main links on the home page begins with one titled Principal’s Note. From here users can read the principal’s welcome letter, view the behavior guidelines, and find answers to frequently asked questions (FAQ). The FAQ link answers questions commonly answered over the phone by our secretaries. The school secretaries asked for this link to be included to relieve them of this responsibility. Future links from this page will include recent achievements and school site council information. With no additional browsers open, one can link up to our school calendar and still remain on the main page. One would simply click on a month to view all of the scheduled activities. The third link was created for the associated student body (ASB). Opening up in a new browser, this site informs students about upcoming events put on by the ASB.
and by our athletics department. Also indicated are the ASB officers and club offerings.

Table 2. BBHS Navigational Links

<table>
<thead>
<tr>
<th>Level One</th>
<th>Level Two</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal’s Note</td>
<td>Welcome</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Achievements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Behavioral Guidelines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>School Site Council</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FAQs</td>
<td></td>
</tr>
<tr>
<td>School Calendar</td>
<td>September</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td></td>
</tr>
<tr>
<td></td>
<td>... through June</td>
<td></td>
</tr>
<tr>
<td>ASB</td>
<td>Clubs</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Class Advisors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASB Officers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Events</td>
<td></td>
</tr>
<tr>
<td>Departments</td>
<td>Physical Education</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Foreign Language</td>
<td>Individual department pages</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td></td>
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<tr>
<td></td>
<td>Social Science</td>
<td></td>
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<tr>
<td></td>
<td>English</td>
<td></td>
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<tr>
<td></td>
<td>Special Education</td>
<td></td>
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<tr>
<td></td>
<td>ROP</td>
<td></td>
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<tr>
<td></td>
<td>Fine Arts</td>
<td></td>
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<tr>
<td></td>
<td>Tech Prep</td>
<td></td>
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<tr>
<td></td>
<td>Student Assisted Classes</td>
<td></td>
</tr>
<tr>
<td>Athletics</td>
<td>Directions to games</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aquinas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrowhead</td>
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</tr>
<tr>
<td></td>
<td>... through 29 Palms</td>
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</tr>
<tr>
<td></td>
<td>Schedules</td>
<td></td>
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<tr>
<td></td>
<td>Teams</td>
<td></td>
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<tr>
<td></td>
<td>Road Conditions</td>
<td>Caltran’s</td>
</tr>
<tr>
<td></td>
<td>Testing Dates</td>
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<td></td>
<td>College Deadlines</td>
<td></td>
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<tr>
<td></td>
<td>Registration</td>
<td></td>
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<tr>
<td></td>
<td>Scholarships</td>
<td>Presentation</td>
</tr>
</tbody>
</table>
The next link connects users to the departments within the school. Due to the size of the project, I requested one member from each department to create their department's main pages. The departments of Physical Education, Mathematics, English, ROP, and Tech Prep provided a representative to learn about the basics of creating web sites and the usefulness it has for educational purposes. Members of this group came together for two afternoons and soon to follow each one created a main page to take back to their departments. Overwhelmed by the creativeness of others, I requested the help of a Physical Education instructor, Patty Barr. Her talent of getting information quickly proved to be a valuable
resource. She also helped to create many of the unrepresented department pages.

Following the departments’ link is a link for our athletes. Proving to be one of the most frequented subsites, the Athletics page offers information helpful to a community living in a remote location. The first link in this site gives users directions to all away game sites. It also allows those coming up the mountain to view directions to our school from the three main points of entry. With unpredictable weather in the mountains, I added a link for the Caltrans road conditions as a safety feature. The schedule of events was added on the main page for quick access and was also included within individual team pages. Each team has its own page containing dates of games, rosters, team pictures, and game results. Our league director hopes that in the future I will create a page where all schools in our league can report, view, and compare game results on a weekly basis.

Under Counselor’s Corner, individuals can obtain information previously dispensed by our counselors. Information can be found on testing dates, college and scholarship deadlines, and about adult classes offered at our school. Alumni can procure transcript information.
without stepping foot into the school. In the long run, I believe this site will save trees since less paper will be used for these simple transactions.

Our staff and students take pride in being a four-time distinguished school. With a small school setting, we instill in our students our underlying theme that our school is "Our House". This sense of ownership has thrived for several decades. For this reason I felt it was important to include a link for alumni of the school. Upon clicking this link, alumni can register to be included in our student database where they can make contact with high school acquaintances. Upcoming reunions and class photos are included in my long-range plans for this site.

The last link to mention on the left frame of the home page is the link for the Media Center. When one clicks on Media Center, they find the target frame split in two horizontal frames. The top introduces the Career Center while the bottom frame brings up our library page. When a student clicks on Career Center they are transferred to a new browser containing school, military, and career information. For students needing information about career options, postgraduate or not, this site is loaded with internal and external links to quality pages. Under the
library link, students can search through our online catalog. A service we subscribe to allows students to search under various topics using multiple Boolean operators. Results returned give a description of the book or periodical and indicate if the book is available, checked out, or overdue.

With the schoolwide links complete, it was time to train our staff to create classroom sites that had educational value. Looking at individual tastes and needs, I discovered this was a task too large to take on alone. With only a handful of teachers competent enough to create pages in the program, I accepted the idea Ms. Barr had to train her associated student body officers to create web pages for teachers who didn’t have the time or energy to begin a new project. Teachers who gave a twenty dollars donation to the freshman class received a professional looking site in return. These students organized the information within each page, searched the Internet for subject matter links, and added subject specific graphics, while working interactively with the instructor. Many instructors continue to use this option for weekly updates for a donation of five dollars per week or per update.
Many staff members preferred to author their own pages. With Claris Home Page being a new program offered at our school, I decided to hold two after school introductory workshops. To help lesson the fears of using the computer and software, I created and distributed simple guidelines for creating web pages within Claris Home Page. Having this packet ahead of time proved to be beneficial at the start of the after school workshop. As we went through the each step towards a basic home page, many who read through the packet gave assistance to others. Collaboratively, we were able to create three individual teacher sites to about 40% completion and four to about 80% completion. More importantly we trained seven more staff members to use the program.

In January, we received our web site address and were up and running. At first students joked that http://bvusd.bigbear.k12.ca.us/bbhs/ was too long of an address to memorize. Over the morning announcements, I could hear the reader take a deep breath, giggle, and then proceed to chant the URL address. Afraid that students wouldn’t check out their school’s new site, I took a student’s suggestion and created a much simpler redirect URL that could be memorized. Using this new feature, when
students typed in bbhs.cjb.net they were transferred to our site at http://bvusd.bigbear.k12.ca.us/bbhs/. Posters of the new address were made and placed in all classrooms.

During our first staff meeting in February, I made a presentation to our staff showing our new site and the pages staff and students created. With the help of the instructors, I presented the departments of English, Math, ROP, Physical Education, Special Education, and Tech Prep. We showed how the web was being used as a classroom tool. For many instructors, the progress that had been made towards completion seemed to come quicker than anticipated. There was a sense of urgency by many to learn more and a sincere appreciation for what had been accomplished.

During this staff meeting, our principal informed us that an additional State Buy Back Day was being offered. Individuals wishing to participate would need to complete seven hours of extra inservice time and would be compensated two hundred, thirty-five dollars. This proved to be motivational. To meet my seven hours, I held two days of after school inservice in the area of web page design. With the training dates being set for April 5th and 6th, I had plenty of time to prepare a presentation and set up a lab of twenty computers.
Formative Evaluation

The purpose for creating this web site is to motivate students to use more technology more often in their classes. As indicated earlier, one way to overcome gender stereotypes is to encourage females to frequently use technology in their studies. Studies show this increased use of technology improves attitudes and satisfaction with mathematics. The challenge was to determine whether or not this goal was being met.

In order to see how frequent the site was being accessed, I place a counter to record the number of hits. This counter on the main page gave me a good indication that students were interacting with the site. But why were they interacting with the web site? From the survey results, the pages I created are worthy of student interaction. The question that needed to be answered was, "Were teachers who were using the site expecting students to interact with it?". In order to evaluate this, I designed an instrument to better understand the opinions and views of these instructors.

The study was administered following the "State Buy Back Day" web design workshop. Of the fourteen teachers, eleven completed all seven hours of their inservice in this
workshop and were given an optional survey to complete. A total of nine returned their surveys of which one chose not to participate. A total of three males and five females participated in the study. These participants come from a wide variety of teaching areas with an average teaching experience of 13.5 years. The subjects that were represented were Art, Business, Physical Education, Culinary Arts, English, and Math.

To get a better understanding of teacher perceptions about male dominated courses, I asked a battery of three questions. The first and second of these questions asked what the instructors favorite and least favorite subject was in high school. The third question asked what subjects they perceive as being male dominated. No commonalties were found on the subjects the participants liked while in high school. However, five of the eight instructors listed math as being the least desired subject. In fact, all but one female, who incidentally teaches mathematics and found it to be her favorite subject while in high school, indicated that math was their least favorite subject. This finding helps to show how damaging stereotypes have been placed on these individuals during their high school years. Nothing significant came out of the third question. I
should have been more specific and indicated that I was looking at "core" classes. Ruling out those who indicated industrial arts as being male dominated, four instructors found math and science to be male dominated.

Using a Likert type scale of 1 to 5, I found this group skilled in using technology. When asked if they use their computer as a management tool, the participants agreed with a mean score of 4.25. The participants further agreed with a median value of 4.5 that they use the computer to present material in class. This supports the idea that these individuals are interested in providing their students a new technology avenue in which to learn from. In fact, five instructors strongly indicated that they require students to use computers for classroom activities at least three times per year.

The third battery of questions asked those participating to reflect on the impact that their classroom web will have on students. The majority (X=4) agreed with the statement that all students have access to an Internet capable computer. With an open lab at our school, this is not a surprising result. Seven participants believed their site had educational value. When asked to indicate how frequent students would be interacting with their site,
participants indicated a range from twice a year to daily. The mode indicated that instructors plan to have students access the site once a week. This finding indicates that the goal of the project has been met. Students will be using technology in a way not previously used. They will be interacting with and within the high school web site. Unanimously, instructors view the web site as a means to lesson the anxieties many students have in using technology and found that creating their pages had relieved some of their computer phobias.

Limitations of the Project

The intention of this project was to motivate teachers to create web pages requiring student interaction. Students are more likely to view pages that are interesting and are easy to navigate through. I have provided a web site where teachers can post their pages. I have motivated many teachers to create a classroom web site, but other teachers have not accepted this idea. Teachers who choose to not create web pages limit students’ opportunity to interact with the site diminishing the affect of this project. Secondly, students who lack access to an Internet ready computer will be limited to the success gained from this project. Finally, the assumption was made that all
students know how to connect and use the Internet to access the school's site. There are probably students who have not learned these skills.

Recommendations for Future Projects

Because the development of a high school web site is an ongoing process, this project will continue without end. Like new versions of popular software, as new ideas come in and as events change, the web site will undergo many alterations. Changes such as adding java code and cgi script will make the site more interactive. To personalize the site, I would like to add pictures of staff and current school events.

Within my classroom, I have my students and their parents interact with the site in various ways. With a click of a button, parents and students can view their current grade and past performance in mathematics. They also retrieve project information and conduct Internet research from my site. It is my desire to include options for help from math Internet sites and, in the future, I would like to include a math chat room for my students to interact within. Creating a rooms that restrict access will allow females the comfort of choosing who they work with.
Web design courses will continue to be held. They will hopefully stimulate ideas to improve and increase the use of this site. It is my hope that teachers will use this site to inform parents of student progress. I would also like to offer parents a yearly introductory meeting giving them the opportunity to be introduced to the site and its educational value. Being awarded Digital High School funds this year will provide more advance computer and technological hardware and increase student access to this technology throughout our school.

It is the intent of this site to promote equality in male dominated subjects such as math and technology. The project of creating this site proves to be a guideline or template for others wishing to make a similar impact. Having educators create web pages diminishes the phobias surrounding technology that often students observe in teachers. As more classroom sites pop up with educational value, the impact of such a creation would stretch beyond our small community out to the world narrowing the gap between genders.
APPENDIX A:

A WORD ABOUT STATISTICAL ANALYSIS

Keeping in the style of the American Psychological Association (APA), statistical data will be presented throughout this document. Since the majority of the articles in my literary review are quantifiable, I have indicated confidence intervals, measures of central tendency and dispersion, degrees of freedom, and other statistical measures. Although statistical measures come in many types, in this section I will briefly describe those seen in this document.

Of the simplest and usually most powerful measures come the measures of central tendency, which include mean, median, and mode. Mean values are usually indicated by a variable with a bar across the top. In this document, \( \text{Me}=4.8 \) indicates that the mean of variable e is 4.8. If only one variable was being tested I used \( X \) to indicate the mean of that variable’s data.

In a normal distribution curve, 95% of all data will be contained within two standard deviations about the mean. This indicates that 5% will lie outside this range. Researchers often relate the confidence of their studies to these percents. Five percent indicates that the researchers
give others that wish to replicate their study a probability of .05 that they will find other results. A stronger study would extend three standard deviations about the mean supporting a hypothesis to a probability of .01. This confidence indicates that if the study was replicated 100 times only in one study would you find statistically different findings. A probability of .001 indicates that in 1000 replicated studies only one would differ.

Correlation compares to variables and its value indicates the type of relationship. Using $r$ for the value of correlation, a value of one indicates perfect correlation where a value of negative one indicates an opposite relationship. With $r=.81$ one would say that as the first variable rises, so does the second. With $r=-.72$ one would say that as the first variable rises the second tends to fall. Lastly, $r=0$ would indicate no relationship.

Other statistical measures indicate relationships between actual and expected results (chi square) and the variance of multiple measures/samples (F-score, ANOVA, and MANOVA), but are not indicated enough in this document to warrant their lengthy explanation.
APPENDIX C:
SOFTWARE EVALUATION FORM

Program Title: ________________________________
Product Number: ________________________________
Cost: $______ single copy, $______ lab pack, $______ network version
Publisher:____________________________________
Address:_____________________________________
Phone (____) _____ - ______

System Requirements:  Product Application:
Computer: _________________________________
Memory (RAM) needed: __________________________
Type of system:
   Standalone:___ Networkable:___
Disk type:
   3.5 disk:___ CD-ROM:___
Operating System: ______________________________
Other system data (if any): _______________________

This product is applicable to the following planned course(s):
____________________________________________
____________________________________________

Please sign:  Reviewer(s):________________________
Date__________________

Directions: The items listed below should be present to ensure an effective program. When evaluating
software, review all guidelines first, and then respond by assigning each guideline with a number within the
given range.

1. Documentation
   ___ Clear Instructions (complete and understandable) 0-4 (you may enter 0,1,2,3 or 4)
   ___ Manual Included 0-4
   ___ Clear goals and specific objectives 0-4

2. Program meets stated goals and objectives 3-8

3. Easy to use 0-6

4. Visually appealing 0-6

5. Can control sound 0 or 3

6. Can enter or exit at any state of the program 0-6

7. Instructional objectives clearly stated 0-8

8. Easily used in existing curriculum 3-9

9. There is a sufficient amount of content. 1-8

10. The system requirements match current hardware 0-10

11. Unique outcomes can result 1-5

12. Students will find this program to be motivating 0-7

13. Students have control over the level of difficulty 0-4

14. The program cost is appropriate considering the current software market 2-8

Total- How many stars?

Rating Criteria: Add the numbers and compare your answer to the chart below.
87-100 ****  78-86 ***  66-77 ** below 66 *
APPENDIX D:

SURVEYS

☐ I am willing to be a participant in your study.
☐ Please don't include me in your study.

I. Personal Information
1. Years of teaching experience
2. Subject you regularly teach
3. Favorite subject in high school
4. Least favorite subject in high school
5. Gender M F

II. Perceptions
1. I perceive the following subjects as being male dominated.
2. I regularly use my classroom computer as a classroom management tool.
   Strongly Disagree Disagree Sometimes Agree Strongly Agree
3. I use my classroom computer to create presentations.
   Strongly Disagree Disagree Sometimes Agree Strongly Agree
4. I require my students to use the computer for classroom activities at least three times per year.
   Strongly Disagree Disagree Sometimes Agree Strongly Agree
5. All students have access to an Internet capable computer.
   Strongly Disagree Disagree Sometimes Agree Strongly Agree

III. Your Web Page
1. Will your students be interacting with your web site? How often?
2. In terms of completion, how do you rank your site? % complete?
3. Does your site have educational value?
4. Has creating a web site in itself relieved some computer phobias?
5. Do you believe an interactive high school web site can lesson the anxieties many students have in using technology?
REFERENCES


Campbell, Patricia. (1986). What's a Nice Girl Like You Doing In a Math Class? Phi Delta Kappan, 516-520.


