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Gender differences in computing: attitudes, use, and stereotypes

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Gender Differences in Computing: Attitudes, Use, and Stereotypes

by
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Dr. Louis Molinari

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Abstract

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Seminar in Elementary Education
Elementary Education Department at Rowan College of New Jersey
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This study was designed to determine the grade level at which students' attitudes towards computers begin to change. Application and gender bias towards computers were also examined. To achieve this, a survey was developed and administered to selected students in the third through eighth grades in the Egg Harbor City School District. In addition to the survey, student's were asked to draw a "computer expert." Comparisons were made between males and females and the elementary and junior high grade levels.

Independent "t" tests were performed to identify significant differences at the .05 level. Significant differences in attitudes towards computers were apparent between female subjects at the elementary level and female subjects at the junior high level. There were also significant differences in attitudes and application between males at the elementary level and males at the junior high level.

This study determined the need for continuing emphasis on promoting equitable computer use at the elementary level. Female role models in computing would be helpful to encourage young girls to pursue careers in computers.

Mini-Abstract

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Both written and graphic documentation of the data are presented to show differences which were identified through the MSO Computer Survey - Student.

This study determined a need for continuing equitable computer access for females at all grade levels. Encouraging female students to enter computer careers in the future must begin in the elementary grade levels and continue into the junior high level.

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Chapter One

Significance of the Study

The computer is acknowledged to be an extremely valuable teaching/learning tool. It has been compared to the "invention of the printing press for it's potential to create revolutionary benefits for all members of society (Nelson & Watson, 1991)." It offers teachers and students opportunities that were never available in the past. Students and teachers can now communicate and develop projects with other students and teachers globally through the use of modems, design instruction for independent needs, and express creative ideas in ways that were never possible.

The computer itself has been described as an object without gender or ethnic bias whereas many teachers may have an unconscious bias and at times may transmit it to students through their teaching. In the past, this idea of an object without gender or ethnic bias seemed to be the equalizer in education - something to "level the playing field." Recently, concern for gender equity and computer equity in education has grown. The National Council of Teachers of Mathematics state, "Women and most minorities are seriously underepresented in careers using science and technology...we cannot afford to have the majority of our population mathematically illiterate. Equity has become an economic necessity (NCTM, 1989)."

With a global economy, and the twentieth-first century nearing, it is the responsibility of the hierarchy of education to address the underrepresentation of women in technological careers. Equal access to computers through course

promotion in the guidance departments of schools must be provided. The term "computer equity", as noted in McCormick and McCoy's (1990) study , "requires awareness, action, and the flexibility to employ differing approaches to meet differing needs. Computer equity means individualizing instruction in computer literacy since students approach this new technology with varying experiences and expectations and interact with computers in different ways (McCormick & McCoy, 1990)." Computers in education are meant for both males and females, however education may be neglecting to provide equal access to students, particularly females, at the elementary and middle school levels.

Studies seem to indicate that student use of computers, at some level, becomes associated with gender. In other words, the gender of the user seems to play a role in the willingness of the student to incorporate the computer in the learning process. Hess and Mulra (1985), in a study on 23 computer camps with 5,533 students, found that "boys attended the computer classes three times more frequently than girls, and this gap increased as the cost and level of classes rose." More support dealing with this widening gap in older students is found in Swadener and Jarrett's (1984) study. They state, "Apparently at about the fourth grade, girl's attitudes towards computers begin to change. Environments like computer clubs, camps, and extra-class computer labs seem to be a male domain. Existing non-business type software appeals more to males than females (Swadener & Jarrett, 1984)." Why are these gaps so prevalent as females move into higher grade levels? Differences in the way females and males interact with the computer may lend itself in determining the kinds of software each likes to work with when given a choice. This study attempts to identify when this difference in attitudes begins to occur. Based on Jarrett's findings and recommendations for further study in the middle school

population, the sample of this study spans grades three through eight.

Turkle has identified "two distinct styles of relating to a computer - a relational style that is artistic, almost tactile, and playful - associated with females...and a risk-taking style that tests the machine's limits - more associated with males (Turkle, 1990)." In other words, males "tend to see the computers as machines which extend their power, getting excited about the computer itself while women approach the computer more relational, seeking ways to capture it's power for the service of and connection with other people (CCT & CCE, 1991)." Males are much more competitive in their use of computers, while females like to work with others and use the computer as an aid to solving problems. How students interact with computers and a teacher's understanding of these differences can help with the implementation of techniques to arrive at computer equity in the classroom.

In addition to the way in which the two genders use the computer, computer programmers seem not to have taken a gender-neutral approach to programming but have, in fact, programmed both computer games as well as educational learning software around the style associated with the male gender (Watson & Nelson, 1991). Nye (1991) states that "curriculum planners structure computer literacy courses around programming, not realizing how this fails to serve all learning styles (Nye 1991)." If this can be shown to be true, it may be a significant factor which contributes to the alienation from the computer as the young female matures and encounters more and more male-oriented computer presentations.

Turkle and Papert (1990) recognize this use discrepancy and suggest that both "in practice and research, both styles exhibited by males and females should be incorporated in computer software. This is particularly true of

educational software (Turkle & Papert, 1990)." Presently, this equitable computer software design is not being done on the retail/home level or most importantly at the educational level. Computer careers are seen as male dominated. Researchers Morse and Daiute (1992) state, "Men design, build, and repair machines and determine their uses; women are consumers of them (Morse & Daiute, 1992)." Since the beginning of the "age of technology", males were the primary developers and users of the computers due to the relationship between programming and mathematical aptitude. This connection has carried over into the marketplace.

For many children, especially boys, "the first encounter with computer software will be in video arcades. Girls, therefore, may approach computer use in school with much more trepidation than boys," states Kiesler (1983). Makrakis (1992), in a study on computer self-efficacy (self-confidence with computers), agrees that increased use would help eliminate the "trepidation" Kiesler contends. Makrakis states, "Studies have shown that people's perceived self-efficacy tends to increase along with the amount of experience and participation in computer related activities (Makrakis, 1992)." It is important for educational software developers to understand this "trepidation" and be aware of the development of computer self-efficacy in order to design software, especially mathematics software, to have the interactive, artistic style Turkle defines so females feel they are truly becoming equal partners in computers and mathematics.

Of noted importance, "it is true that women are holding more computer-related jobs. However, most are clerical or require little training (Shashaani, 1992)." Most of the "personally and financially rewarding careers in our society depend upon the ability to make creative use of the new technology, the

computer (Shashaani, 1992)." As mentioned earlier, students are being given the opportunity to extend this creativity into an economic advantage. For some females, however, the computer will only be a "glamorized typewriter" that will continue to keep women in a stereotypical role as secretary.

Stereotypical roles in technological careers are emphasized in media presentations - computer catalogs and computer advertisements in magazines. Ware and Stuck's (1985) study found that in media presentations "approximately one-third of the illustrations had the representations of equality, and less than 15% had females in power positions." These options will only open when females at a young age are encouraged to take control of their learning and demand equity at all levels of computing. Software designers need to become sensitized and develop programs for both males and females.

Educators must also be aware and scrutinizing of the software being purchased for their classrooms. Educational software has been identified as a helpful tool to reinforce skills taught in the classroom. A child's initial exposure to computers and their applications is in the primary grades. The software marketed for these levels is questionable in it's level of gender equity. In a study by Muira and Hess (1985), computer software was found to be sex-typed. They concluded that "more titles were perceived by adults and students as being of interest to males than females...approximately one third of the titles were rated as being of primary interest to males, compared to five percent that were rated as being of primary interest to females (Muira & Hess 1985)."

More support regarding software being male-oriented is found in Kiesler's article, "Second Class Citizens." Kiesler (1983) states that "much of the software decidedly fulfills stereotypical expectations of 'male' interests. The software sold for home computers offers an array of land battles, space wars,

and other forms of destruction, as well as typically male sports (Kiesler, 1983)." This is an extension and reinforcement of the video arcade. When boys begin school or enter computer classes with this background, they have an advantage over girls. Girls spend less time than boys playing computer and video games. Therefore, they miss the opportunity to develop the skills necessary for the computer learning environment and come to the computer with less experience (Kiesler, 1983). Thus, young female's computer self-efficacy is low and continues to diminish as they get older. If the educational system or societal influences do not change, females will remain in a somewhat subdued role. This study aims to discover at what grade level this change in computer self-efficacy is occurring, and the degree of separation from comparable males at various grade levels.

Another factor involved with software development and gender is that computers are closely associated with mathematics - particularly problem solving and spatial ability (Linn, 1983). Research by Linn (1983) discovers that in the early teen years, "discrepancies between boys and girls in mathematics arise in the areas of problem-solving and spatial ability, two areas closely associated with computing (Linn, 1983)." Experience with these types of skills in the software market need to be available to females in the classrooms at an early age.

In addition to software, societal influences, and student attitudes, teacher role models are found to influence gender equity in computing. Todman and Dick's (1992) study addressed the issue of teacher attitudes and their effect on student attitudes. They found that, "at about the fifth and seventh grade levels, a substantial proportion of the variability in the children's attitudes is predicted by the attitudes of their teachers, with some indication that the relationship is

stronger for boys at the fifth grade level and for girls at the seventh grade level (Todman & Dick, 1992)."

Another finding which points to the need to study gender differences at the upper elementary level is that Todman and Dick (1992) found "clear evidence that boys were more [favourably] disposed to computers than girls at the primary level." They also found that "there may be a general tendency for children to regard computers as progressively less fun through their primary years." As students move towards the higher grades and toward economic independence, it will be important for them to feel positively towards the technology that will be part of their everyday life.

This study attempts to identify the grade level at which student's attitudes change toward computers. It will also attempt to find if a teacher's attitude is influential in creating positive or negative student's attitudes towards computing.

Statement of the Problem

Could it be that as students get older, their attitudes towards computers change and they begin to think of computers in a biased way.

Purpose of the Study

The purpose of this descriptive study is to determine at what grade level students attitudes towards computers change. It will also attempt to determine at what grade level student's use of computers changes. Teacher attitudes

towards computers will also be examined to see if there is a relationship between their attitudes and their student's attitudes.

More specifically, the study will use data gathered from the MSO Computer Survey -Student and MSO Computer Survey - Teacher surveys to determine if there are differences between male and female student's attitudes towards computers in grades three through eight, and compare the teacher's attitudes to those of their students. Based on previous research, the relationship between attitudes and gender bias towards computers is influenced by factors such as self-confidence, society, and educational influences. The change in attitudes towards computers tends to appear in the upper elementary grade levels.

Specific Hypotheses

I. There will be no significant differences in attitudes towards computers between the male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

II. There will be no significant differences in attitudes towards computers between the male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

III. There will be no significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

IV. There will be no significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

V. There will be no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

VI. There will be no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

VII. There will be no significant differences in computer use between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

VIII. There will be no significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Method of Study

Students in six classes grades three through eight, along with their classroom teachers in the Egg Harbor City School District, were administered the MSO Computer Survey. The purpose of the survey was to discover the grade level at which attitudes towards computers change. Factors of gender and application and their relationship to attitudes towards computers were also investigated.

An illustration of a "computer expert" was also included in the survey and analyzed for characterisitics of stereotypical male scientists or mathematicians, and the gender of the "expert" in comparison with the illustrator. The purpose of the illustration was to further explore the relationship of the gender of the

illustrator to the gender of the "computer expert".

Limitations of the Study

The following limitations were evident in the study:

1. The fact that only 115 students in one school dictrict were surveyed must be recognized as a limitation.

2. Technical problems with the computer network in both buildings for six months must be recognized as a limitation since the survey deals with attitudes and the use of computers.

3. The conditions of survey administration must be recognized as a limitation since one person did not administer all the surveys.

Definitions of Terms Used

The following is a list of terms that may need defining:

1) *application* - Student's use of computers.

2) *Elementary grade level* - Students in third or fourth grade housed in the Charles L. Spragg School.

3) *Junior high grade level* - Students in fifth through eighth grade housed in the Fanny D. Rittenberg School.

Organization of the Study

Chapter One presents as overview of the problem and the design of the study. Contained in this chapter is the significance of the study, statement of the problem, statement of the specific hypotheses, and method of study. Also included are limitations, definitions of terms used, and organization of the study.

Chapter Two presents a review of the literature and it's relevance to the study.

Chapter Three presents the design of the study. A description of the setting, sample, and population are given. Validity of the instrument is discussed and the relationship of the instrument to the null hypotheses is included. A description of the instrument, scoring procedures, administration procedures for the survey, and time period for data collection and tabulation are also included.

Chapter Four is the analysis of the data. Statistical and descriptive analyses are used and presented.

Chapter Five reviews the procedure followed in the study. Results and conclusions of the study are discussed. Recommendations for further study are presented.

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Review of the Literature

Several factors, research shows, have been identified as contributors of gender bias in computing. The factors can be categorized as:

Attitude/Performance - How a child perceives the computer and it's use, their level computer literacy, computer self-efficacy, access and experience.

Family/Societal Influences - How the family contributes to/promotes a male/female child's success with computers. Societal influences include the impact of computer advertisers, and socialization within schools.

Educator Influences - Teacher role models, knowledge and computer use. Their attitudes towards computers as an important component of learning.

The issue of gender equity and it's effects on learning are not new. Kirk (1992) suggests that "before computers were introduced into schools, gender inequalities already existed, particularly in traditional curriculum areas.

Information technology alone has not created these inequalities but has the potential to compound or sever such ties." Much of the research tends to focus on the computer itself and not the student's attitudes, societal influences, or familial components that have influenced gender equity for years.

With the advent of technology, gender differences in computing were identified in the late seventies and early eighties "primarily as a component of math anxiety (Nelson & Watson, 1991)." However, this component diminished as computer software expanded into other areas of the curriculum - ie. word processing, desktop publishing, multimedia. "Factors which now are identified as shaping the computing skills gender disparity range from interpersonal interactions within the family and school to software selection (Nelson & Watson, 1991)."

Schools were instituted to transfer culture. Since the primary grades are so influential in providing a base for computer equity, research has found that the socialization factor is significant from a child's early experience in school. Morse (1992) states that "from the early grades of elementary school, it is common for classrooms to be highly segregated both in seating arrangements and for group work. Compared to adults, children in the first grade view more activities as suitable only for one sex." This develops into the middle grades. Morse (1992) further states that, "girls tend to underestimate their performance in general, but particularly in subjects considered to be male activities." Minuchin and Shapiro (1986) support this by stating, "From a very early age, children are made aware that their choices and performances are going to determine both the quality of their experience in school and their subsequent career choices."

Similarly, Forsyth and Lancy (1989) also agree in their study that, "the

gender difference means that girls will, in all likelihood, do poorly in or avoid courses that demand computer facility. This may lead to a narrower range of academic and professional options being open to them." It seems the economic ramifications, as the researchers state, could be great as the "baby-boomers" of the technology age grow into job-seeking professionals.

Hence, the effects of socialization in the early elementary grades seems to be significant in the development of gender equity issues alone. Add the integration of computer technology, and the gender equity issue has, as stated earlier, economic effects.

Research shows that women's low representation in the computer field appears to be deeply rooted in the way they are socialized in early education. This socialization pattern is significant in Shashanni's (1992) study which shows "strong positive correlations between a student's interest in computers and the amount of encouragement they received from their parents, teachers, and school counselors. In regard to parental influence, the low self-confidence of female students was strongly correlated with their perceived father's beliefs that the computer is more appropriate for males than for females." The study also found that there was a "sharp difference between boys and girls with respect to self-confidence in using computers." However, girls felt that women as a whole are capable of learning about computers, but had low self-confidence in their own ability.

A student's attitude towards computers is translated into student's "computer self-efficacy." Makrakis (1992) defines computer self-efficacy as "general self-esteem or personal confidence in the ability to learn about or with computers and to perform well on computer-related tasks." Makrakis furthers suggests that "societal influences such as parents, teachers, and peers may

perpetuate a low self-efficacy." An important finding in Makrakis' study, similar to Shashanni's, showed that "females responded very positively to the statement: 'females can do just as well as males in learning about computers'." In contrast, however, as soon as females were asked to assess their own self-efficacy, "they shifted in their judgments, reporting less conviction of their self-efficacy in computing as individuals (Makrakis, 1992)." This has been coined, the "We Can, I Can't Paradox" - the feeling that females are unsure of their personal ability in computing, but feel that females as a whole are just as able as males in computing.

Collis' (1987) study supports this finding by concluding that "there are significant sex differences in attitudes towards computers in a secondary school population. These attitudes are established by grade eight. Boys are more interested in computers and are less likely to feel negatively about the impact of computers on society." The study further finds boys were significantly more confident than girls about their potential with computers.

To be less knowledgeable about the basic aspects of computer technology is to be less able to participate in our culture. Experience with computers may improve girl's attitudes towards computers. In a study done by Sacks, Bellisimino, and Mergendoller (1993), "girls' attitudes towards computers were more positive after having had experience with computers." Interestingly, boys' attitudes remained the same. Perhaps this is because "boys already have attitudes and behavioral expectations towards computers. These attitudes and expectancies may be socialized by a society that encourages boys to be proficient in all things 'technological' (Sacks, Bellisimino, & Mergendoller 1993)."

Since technology and science are rated by adults as being one domain, researchers Barba and Mason (1992) wanted to analyze if children felt the same way. This study had children in grades K-12 draw a computer user . This was quite a different way to gather data compared to conventional questionnaires and surveys. The researchers hypothesized that children would draw computer users in stereotypical forms as they do for other occupations.

They also hypothesized that the children would draw stereotypical "scientists" otherwise termed , nerd (black-rimmed glasses, high water pants, pocket protector, oil-slicked hair parted in the middle, etc.). This was based on previous findings from research based on adults viewing science and technology as being firmly linked. The findings in elementary children's drawings indicated virtually no instances of "nerd" depictions in their drawings. In the fourth grade, however, the computer user was drawn as a stereotypical "nerd." The higher the grade level, the greater correlation of "nerd" depictions in the drawings (Barba & Mason, 1992).

In accordance with this view, Swadener and Jarrett (1994) found in their study on computing gender differences that "at about the fourth grade level, girl's attitudes towards computers begin to change."

Barba and Mason (1992) also contended that while adults "tend to view science and technology as being a undifferentiated meld, young children view computer technologies as part of everyday life, as part of many careers. Children do not see computer technology as a product of science, but as the use of technology in everyday life. However, as they mature and pass through their adolescent years, their image of computer users changes." This nerd image can compound the already increasing gender gap during the adolescent years. Even though young children view technology as a part of many careers,

not just science, as children get older, something is happening to change this attitude that computers are a male domain.

At this level, research has shown that both boys and girls see computers as a male domain. In a study done by Wilder, Mackie, and Cooper (1985), attitudes towards computers and other stereotypical topics were measured for students in K-12. Opposite the findings in the drawing study, differences were found in very young children when identifying what is male appropriate. As early as kindergarten, "boys and girls view video games as more appropriate to boys than to girls. Although the computer is seen more neutrally, there is a very slight tendency for children to see it as a more masculine than feminine item." Wilder et al. (1985) also found that "even among equally experienced respondents, females still underrated their ease of interaction and their skill compared to males."

"Given enrollment trends in science and mathematics which have consistently favored boys, it is not surprising to find a similar trend in the area of computer studies. Not only are fewer girls exposed to computers in the classroom, but girls also have less positive attitudes towards computers (Fetler, 1985)." As stated earlier, computer technology is closely associated with science and mathematics in the minds of many, and the attitudes that have discouraged the participation of women in technical studies are probably operating in the area of computer studies (Fetler, 1985).

In addition, Reinen and Plomp's (1993) study on gender and computers found that "computer use in schools is dominated by men. The numbers support the concerns of many policy makers, educational professionals, and those involved in gender equity in this field, that the daily practical situations in which computers are used in schools conveys too much of a suggestion that

working with computers is an activity for men and not for women." The way computers are used in the schools needs to change in order to give students an equitable opportunity where many first gain experience with computers.

Females use the computer as a way to relate to others. Research has shown that girls have a "relational style of computing (Turkle, 1990)." The girls "primarily orient themselves towards each other, the human relation seems more essential to them than the object they work with. They orient themselves emotionally towards each other, and their work style is collective. In their use of language they rely on open suggestions, which invite further communication and to the strengthening of the human interaction (Nielsen, 1985)." They relate to the computer with others, seeking advice from others when interacting with computers.

Boys, on the other hand, see the computer as an object - "it becomes the mean, through which the human relation is established...boys relate to each other through the object, not directly (Nielson, 1985)." They are much more independent and competitive in their interaction.

In a study done by the Center for Children and Technology (1991), several instances occurred where the boys were identified by their peers as the "experts" in programming LOGO. However, gender differences were not apparent when word processing was used. Similarly, gender differences were not apparent when programs that involved working cooperatively with others were used.

In support of this, Sacks, Bellisimo, and Mergendoller's findings "showed little or no gender differences in computer use for word processing." When females are comfortable with the way a piece of software works, they will have a more positive attitude towards computer use.

Societal influences promote gender differences by means of media presentations. In a study conducted by Ware and Stuck (1985), they found, "sex differences were significant in a number of role portrayals. Women were underepresented significantly as managers, experts, and repair technicians. Women were over represented significantly as sellers, clerical workers, and sex objects. Except for the role of the seller, these representations (clerical and sex object) are stereotypic." Women placed in these roles in the media reinforce the stereotype to influential adolescents.

Female students, in a comparative study of 16 - 18 year old students from done in a Scotland University, could not see themselves as a computer specialist "hunched over their terminal all day having little contact with human beings and restricted in their future career patterns." This may be because of the way females like to use the computer in terms of helping people or working cooperatively. They also felt that even though they had access to computers in the last two years of high school, it was not enough to make them feel comfortable in selecting a career in computers (Durndell & Lightbody, 1993).

The Scotland study also showed little gender differentiation in computer use, however computer ownership showed a trend that favored males (Durndell & Lightbody, 1993). It was also concluded that, "overall the results of the present study and related work in Great Britain would seem to point to a small and limited change over time in female as compared with male involvement with computing, with very slightly greater female participation developing (Durndell & Lightbody, 1993)."

A study done by Swadener and Jarret (1984) supports this by claiming, "From the categories of usage, it appears that in the middle grade content areas, computer use does not differ greatly between boys and

girls...extracurricular use of computer games (apparently dominated by boys) is the greatest difference between boys' and girls' use of computers. The study also concluded that more boys have computer access at home. Middle grade boys also "see males as the most common home computer users and females as the least common home computer users (Swadener & Jarrett, 1984)." However, girls perceive women as computer users more frequently than do boys. Girls are much more positive towards computers when dealing with "gender-free" software that creates things and is user-friendly (Swadener & Jarrett, 1993).

Experience with computers is developed and fostered through the home or school. A teacher's computer self-efficacy can promote student's positive feelings for the computer at all levels of schooling. However, research shows that female teacher leaders in computers are not in correlation with the percentage of female teachers in the primary levels. In a study conducted in 1993, a "small, sometimes very small percentage of schools have a female computer coordinator...the conclusion is that role models for computer use shows the under representation of women (Reinen & Plomp, 1993).

Particularly for females, the promotion of female role models in computing may be hampered by the fact that many of the teachers who teach computer education classes also teach math and science classes. Reinin and Plomp's study found that "computer use seems, in practice, often to be coupled with mathematics and science. There appears to be a confirmation that computer education is stereotyped as a 'hard science subject' (Reinin & Plomp, 1993)." Based on this finding, it would appear that most teachers who teach computers are also mathematics or science teachers.

According to Becker (1985), a survey of "primary computer-using

teachers (PCUT's) found that "compared to the overall population of elementary and secondary school teachers, there were more men among PCUT's than among teachers as a whole." At the secondary level, women PCUT's were in the business education area while men PCUT's in areas that involved the computer as an object of instruction.

Also, the "relational" (Turkle, 1990) style of computing seems to help females "expand computer use in the school by interesting other teachers in micros (Becker, 1985)." Becker's study further found that "the average number of teachers...who were regular computer users was greater where women were PCUT's."

In a study by Stasz, Shavelson, and Stasz (1983), the issue of teachers as computing role models is examined. They contend that "it has long been a principle of sex equity in education that girls need to see females enacting roles in fields normally identified as male. It is further held that the female role models will be most effective if they are clearly competent and show enthusiasm for their work (Stasz, Shavelson, & Stasz, 1983)." Teachers, particularly female, and parents need to encourage females to explore traditionally male fields.

Teacher training is an issue to address since teacher's confidence and experience with computers can affect their attitudes. Nelson and Watson (1991) argue that "teachers have been discouraged through the physical placement of computers and through inadequate in-service training to integrate this technology into the classrooms in creative and innovative ways." This, the researchers believe, leads to negative attitudes which are "thought to be directly transmitted from female teacher to female student, thereby perpetuating the 'gap'."

The relationship between student attitudes and teacher attitudes towards

computers has been studied as a factor involved in computing equity. Todman and Dick's (1992) study on computers and student attitudes found that there were "generally [favourable] attitudes to computers (Todman & Dick, 1992)." Student's attitudes were "considered in relationship to those of their teacher's and in relationship to general characteristics of their schools (Todman & Dick, 1992)." At the fifth and seventh grade levels, where the search of the literature has found the greatest change in student's attitudes, "substantial proportion of the variability in the children's attitudes is predicted by the attitudes of their teacher, with some indication that the relationship is stronger for boys at the fifth grade level and for girls at the seventh grade level (Todman & Dick, 1992)." Todman and Dick (1992) further conclude that "one very tentative possibility suggested by the patterns of differences obtained is that there are different periods during which the attitudes of the teachers particularly influence the attitudes of their male and female pupils respectively."

Another conclusion was that "although girls at the primary level are not so impressed as boys by the fun and usefulness aspects of the computers, they are just as confident as boys in their ability to use them (Todman & Dick, 1992)." Given this evidence, it appears that females' confidence as a whole group, as found in previous studies tends to be high. However, this may be supporting the "We Can't, I Can't" attitude studied by Collis (1987) which claims that females feel confident about other women's abilities, but feel low self-confidence about their own (Collis, 1987).

Shashaani's (1992) study also found a "strong and positive relation between female's low self-confidence and perceived teacher's beliefs that computing is mostly a man's job (Shashaani, 1992)." It was concluded that, "a positive correlation was observed between lack of interest and confidence of

female students to use computers, and their socializer's belief of the inappropriateness of computers for girls." This is more evidence that teachers are very influential, in terms of computing, to their female students.

However, Kay (1992) argues that male and female preservice teacher's attitudes and intentions to using the computer were the same. Kay (1992) cautions that while "male advantages in computer ability and control almost disappear when math/science and verbal ability are controlled for, the practical reality exists that male teachers may be more able and in control with respect to computer use (Kay, 1992)." It is a hopeful finding since the study is relatively new and the subjects were student teachers. The fact that the female teachers were positive about their intentions for using the computer is a change from the previous studies mentioned.

In conclusion, based on the articles and studies done on gender issues in computing, there is still much to be examined in this area. In particular, the middle school level and the effects of teacher's attitudes must be explored further so educational leaders can make decisions that will create more opportunities for females in computing.

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Chapter Three

Design of the Study

Introduction

This study was designed to compare student's attitudes towards computers, and identify at what grade level any changes in attitudes are occurring. Surveys were administered to 103 students in grades three through eight in the Egg Harbor City School District.

Setting

Egg Harbor City is a small rural town located in Atlantic County. It has a multicultural population of approximately 4,500 residents.

There are two public schools in the Egg Harbor City School District. The Charles L. Spragg School houses kindergarten through fourth grade. The Fanny D. Rittenberg School houses grades five through eight. The total district enrollment as of 10/15/94 was 585 students. All classes are heterogeneously grouped. The ethnic breakdown of the district is 41.4% Caucasian, 19.9% African-American, 37.7% Hispanic, and 0.9% Asian. The male/female distribution is 51% male, and 49% female.

The Egg Harbor City School District, in 1990, was one of the first in Atlantic County to network their computers for instructional purposes. Instead of networking a one room computer lab, the administrators and district computer

specialists decided it would be best to keep the computers in the classrooms where students would get the most access.

Each classroom in the Fanny D. Rittenberg School has two to four Apple IIe computers networked to a Corvus harddrive. In the Charles L. Spragg School, the computers are also networked to a Corvus harddrive and the same number of computers (2) are in each classroom.

Students and teachers have the opportunity to utilize the software lessons on the network for academic remediation, various computer games, AppleWorks word processing, as well as stand-alone software housed in the classroom and library resource center. An extensive software guide describes all the software and aligns it to the curriculum. Teachers are encouraged by the administrators to utilize the technology often.

Description of the Population & Sample

The population of this sample consisted of six heterogeneously grouped classes. One class per grade level from grades three through eight were used. The mean class size was 19. Fifty-four percent of the population were female and 46% were male. Three females and three males comprised the teacher population.

Description of the Instrument

The MSO Computer Survey - Student was designed specifically for this study. It is a thirty-three item survey designed to measure student's gender bias, attitudes towards computers, and computer use or application.

Thirty-three questions were equally divided into three categories in order to address the factors of gender bias, attitude, and application or use. The gender bias questions were designed and analyzed differently than the attitude and application quesitons. Questions #1, #3, #4, #6, #20, #21, #22, #26, #28, #29,& #32 address gender bias. Questions #20 & #21, respectively, on the MSO Computer Survey - Student attempted to identify gender bias by asking the respondent to select the best careers for girls and the best careers for boys. Questions #6 & #22 on the survey attempted to identify gender bias in terms of software selections. In addition to the questions, a final aspect to identify gender bias was added to the survey. Similar to Barba and Mason's study, the students were asked to draw a "computer expert".

Questions #2, #3, #10, #11, #12, #14, #19, #25, #27, #30, & #31 addressed attitudes towards computers.

Questions #5, #8, #9, #13, #15, #16, #17, #18, #23, #24, & #33 addressed student's application of computers. Question #23 asked the respondent to identify the subject areas where they used computers.

The survey attempted to identify the following:

* student's attitudes towards computers
* student's perceived self-confidence with computers
* student's preferences for computers as a significant activity in their lives
* student's stereotyping of computer users
* student's perception of teacher's confidence and knowledge of computers

The classroom teacher answered the MSO Computer Survey - Teacher

which was also designed for this study. It is a 30 item survey which attempts to identify gender bias, attitude towards computers, and application. The 10 gender bias questions attempted to discover the teacher's feelings about females and males and how they interact with the computers. The 10 attitude questions attempted to identify the teacher's attitudes towards computers and their inclusion in the classroom. The 10 application questions attempted to identify how the teacher uses the computer in their everyday lives.

The MSO Computer Survey - Teacher attempted to identify:

* teacher's attitudes towards computers

* teacher's perceived self confidence with computers

* teacher's preferences for computers as an important element of their teaching

* teacher's stereotyping of computer users

*teacher's perception of computer equity in their classroom

Both the student and teacher surveys are structured using a Likert-type scale for responses of "Strongly Disagree", "Disagree", "No Opinion", "Agree", and "Strongly Agree".

For scoring purposes, positive statements which were answered with "Strongly Disagree" were given 1 point; "Disagree" was given 2 points; "No Opinion" was given 3 points; "Agree" was given 4 points; and "Strongly Agree" was given 5 points. With respect to negative statements, a "Strongly Disagree" was given a score of 5; "Disagree" was given a score of 4; "No Opinion" was given a score of 3; "Agree" was given a score of 2; "Strongly Agree" was given a score of 1. In the event of a blank response, the researcher gave a value of three which is equivalent to "No Opinion."

Questions #6 and #22 were scored by tallying the number of "Agree" and "Strongly Agree" responses for software selection for boys and girls. Questions #20 and #21 were tallied by making a chart and listing the careers. A tally mark was given for "Disagree" (including "Strongly Disagree" responses), "No Opinion", and "Agree" (including "Strongly Agree" responses". Percentages of selections of agreement or disagreement were calculated and compared. Question #23 was tallied by making a chart listing the subjects and counting the "Agree" and "Strongly Agree" columns. The percentages of choice for each subject were calculated and compared.

For validity, the survey was constructed through discussions with teachers, mathematics professionals, school psychologists, and guidance counselors. Suggestions were made as to what items to include in the survey, and attention was given to the wording of the questions. A copy of the survey was given to each of the professional participants. Analysis of the questions were done prior to survey distribution. These suggestions were taken into consideration and included in the survey.

The Relationship of the Instrument to the Null Hypotheses

The general hypothesis states that there will be no significant difference in the attitudes of students towards computers at the elementary and junior high levels. The MSO Computer Survey - Student (Appendix A) was used to collect the data. The completed surveys were compared and similarities and differences were identified based on sex and grade level. The student's drawings were examined and notes were made as to the stereotypical characteristics such as sex, mathematical or science expertise, male "mad

scientist" or "nerd" depictions such as pocket protectors and black-rimmed glasses. Female characterisitics included long hair, dresses, long eyelashes, and makeup. Also of interest to the researcher is the number of people in the drawing, location of the computer, and use of the computer identifiable in the drawings.

The MSO Computer Survey - Teacher (Appendix B) was used to collect data from the student's classroom teacher. Upon completion, the surveys were compared with the results of their student's surveys. Similarities and differences in comparison to their student's results were noted. Teacher's drawings of the "computer expert" were also examined for the same characteristics in the student's drawings.

Procedure

The MSO Computer surveys were distributed to the participating classroom teachers by the researcher. The researcher explained the purpose of the survey and the procedure for administration was explained by the researcher to the classroom teacher.

The classroom teachers administered the MSO Computer Survey - Student to their class during the first period homeroom class. Students were read the instructions and an explanation of how to answer the 5-point Likert type selection was given.

While the students were completing their survey, the teacher completed his/her survey. When all the students and teacher were finished, the teacher collected the surveys and returned them to the researcher for tabulation. The time period for survey administration and data collection was two weeks from

the time the sample received the instrument.

Summary

This chapter discussed the setting, population, and testing instrument used. A description of the instrument and relationship to the null hypothesis was included. The survey gathered data from 115 students in the Egg Harbor City School District. Analysis of the data, discussion, and conclusions will be included in the following chapters.

Chapter Four

Analysis of the Data

Introduction

The MSO Computer Survey -Student was administered to 103 students in the Egg Harbor City School District. This study attempted to identify when student's attitudes towards computers begin to change. It also attempted to identify when student's computer use begins to change.

The data was statistically analyzed. The researcher used an independent t-test to determine if there were significant differences between the attitude means of female students and male students at different grade levels. T-tests were also used to determine significant differences between the application means of female students and male students at different grade levels. For this study, differences were considered significant at the .05 level. Specific questions addressing the factors of gender bias and application were also analyzed. Gender bias questions were analyzed descriptively and comparisons made at different grade levels. One application question was analyzed descriptively to show which subject areas the computer was used the most.

Due to the small sample of teachers, the researcher decided not to include them in the analysis.

Tests of the Hypotheses and Results

The specific hypotheses are:

I. There will be no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

II. There will be no significant differences in attitudes towards computers between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

III. There will be no significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level as measures by the MSO Computer Survey - Student.

IV. There will be no significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

V. There will be no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

VI. There will be no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

VII. There will be no significant differences in computer use between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

VIII. There will be no significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table I presents the mean attitude scores of the MSO Computer Survey - Student by grade level and gender in the Egg Harbor City School District. The results are entered in Table I by the numerical value given to each attitude question in the MSO Computer Survey - Student. The scores can range from one which is the lowest score to five being the highest positive score. The scores in Table I range from 3.57 to 4.014 for females and 3.357 to 3.978 for males.

In the Egg Harbor City School District, twenty students were surveyed in the third grade. The total mean score for females in the third grade was 3.655. The total mean score for males in the third grade was 3.967.

Twenty-two students were surveyed in the fourth grade. The total mean score for females in the fourth grade was 3.571. The total mean score for males

in the fourth grade was 3.850.

Eighteen students were surveyed in the fifth grade. The total mean score for females in the fifth grade was 4.014. The total mean score for males in the fifth grade was 3.627.

Nineteen students were surveyed in the sixth grade. The total mean score for females in the sixth grade was 3.925. The total mean score for males in the sixth grade was 3.357.

Eighteen students were surveyed in the seventh grade. The total mean score for females in the seventh grade was 3.944. The total mean score for males in the seventh grade was 3.978.

Seventeen students were surveyed in the eighth grade. The total mean score for females in the eighth grade was 3.812. The total mean score for males in the eighth grade was 3.767.

From Table I, it can be seen that for females in the entire sample, fifth grade females with a mean score of 4.014, had the highest attitude towards computers. Fourth grade females had the lowest attitude towards computers with a mean score of 3.571.

Also illustrated in Table I, for males in the entire sample it can be seen that seventh grade males, with a mean score of 3.978, had the highest attitude towards computers. Sixth grade males had the lowest male attitude score with a mean of 3.357.

Table I

Number of Students and Mean Attitude Scores for Males and Females by Grade Level in the Egg Harbor City School District

Grade	N	Female	Male
3	20	3.655	3.967
4	22	3.571	3.850
5	18	4.014	3.627
6	19	3.925	3.357
7	18	3.944	3.978
8	17	3.812	3.757

Hypothesis I states that there will be no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

The mean scores were clustered by gender into elementary levels (3rd - 4th) and junior high levels (5th - 8th). The mean scores were then subjected to the Analysis of Variance to determine the deviation score. A t-test was used to determine if a statistically significant difference existed between the attitude scores of the students. The .05 level of confidence was used to determine significance. The means and the standard deviations of the scores of elementary level females and elementary level males are presented in Table II.

In Table II, it can be seen that for males at the elementary level, the mean score was 3.912. For females at the elementary level, the mean score was 3.608. A "t" score of -1.907 was computed. The "t" value needed for

significance at the .05 level was 2.120. This indicated that no significant differences existed between the variance of these two groups. Therefore, Hypothesis I was accepted. There were no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Table II

"t" Test of the Difference Between Attitude Means for Males and Females at the Elementary Level.

Gender	N	Mean	S D	"t"
Male	17	3.912	.478	
Female	25	3.608	.621	
				-1.907

Hypothesis II states that there will be no significant differences in attitudes between the male and female subjects at the junior high level as measured by the MSO Computer Survey - Student. The mean scores were calculated for the male and female subjects at the junior high level. These scores were used to do an Analysis of Variance to determine the deviation score. A "t" test was used to determine if a statistically significant difference existed between males at the junior high level and females at the junior high level. The means and standard deviations of the two groups are presented in Table III.

In Table III, it can be seen that males at the junior high level had a mean

score of 3.64. Females at the junior high level had a mean score of 3.922. The "t" score of 1.276 was computed. The "t" value needed for significance at the .05 level was 2.030. This indicated that no significant differences existed between the groups. Therefore, Hypothesis II was accepted. There were no significant difference in attitudes towards computers between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table III

"t" Test of the Difference Between Attitude Means for Males and Females at the Junior High Level

Gender	N	Mean	S D	"t"
Male	25	3.64	.673	
Female	36	3.922	.487	
				1.276

Hypothesis III states that there will be no significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

The mean scores were calculated for female subjects at the elementary level and female subjects at the junior high level. These scores were subjected to an Analysis of Variance to determine the deviation score. A "t" test was used

to determine if a statistically significant difference existed between females at the elementary level and females at the junior high level. The means and standard deviations are presented in Table IV.

In Table IV, it can be seen that females at the elementary level had a mean score of 3.608. Females at the junior high level had a mean score of 3.922. The "t" score of -2.453. was computed. The "t" value needed for significance at the .05 level was 2.064. This indicated that significant differences existed between the two groups. Therefore, Hypothesis III was rejected. There were significant differences between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table IV

"t" Test of the Difference Between the Attitude Means for Females at the Elementary Level and Females at the Junior High Level.

Level	N	Mean	S D	"t"
Elementary	25	3.608	.621	
Junior High	36	3.922	.487	
				-2.453

Hypothesis IV states that there will be no significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer

Survey - Student.

The mean scores were calculated and used to do an Analysis of Variance to determine the deviation score. A "t" test was used to determine if a statistically significant difference existed between male subjects at the elementary level and male subjects at the junior high level. The means and standard deviations of the two groups are presented in Table V.

In Table V, it can be seen that males at the elementary level had a mean score of 3.912 and males at the junior high level had a mean score of 3.64. The "t" score of 2.359 was computed. The "t" value needed for significance at the .05 level was 2.120. This indicated that a significant difference existed between the variance of these groups. Therefore, Hypothesis IV was rejected. There was a significant difference in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table V

"t" Test of the Difference Between Attitude Means for Males at the Elementary Level and Males at the Junior High Level

Level	**N**	**Mean**	**S D**	**"t"**
Elementary	17	3.912	.478	
Junior High	25	3.64	.673	
				2.359

Table VI presents the mean application scores of the MSO Computer Survey - Student at the elementary and junior high levels by gender in the Egg Harbor City School District. The results are entered in Table VI by the numerical value given to each application question. A one is the lowest negative application score. A five is the highest positive score.

In the Egg Harbor City School District, twenty students in the third grade were surveyed. The mean application score for females in the third grade was 3.564. The mean application score for males in the third grade was 3.944.

Twenty-two students in the fourth grade were surveyed. The mean application score for females in the fourth grade was 3.379. The mean application score for males in the fourth grade was 3.588.

Eighteen students in the fifth grade were surveyed. The mean application score for females in the fifth grade was 3.612. The mean application score for males in the fifth grade was 3.555.

Nineteen students in the sixth grade were surveyed. The mean application score for females in the sixth grade was 3.633. The mean application score for males in the sixth grade was 3.214.

Eighteen students in the seventh grade were surveyed. The mean application score for females in the seventh grade was 3.457. The mean application score for males in the seventh grade was 3.867.

Seventeen students in the eighth grade were surveyed. The mean application score for females in the eighth grade was 3.738. The mean application score for males in the eighth grade was 3.522.

As Table VI illustrates, it can be seen that eighth grade females have the highest female application mean of 3.738. The lowest female application mean is 3.379 in the fourth grade. The highest male application score is third grade

with a mean of 3.944. The lowest male application score is sixth grade with a mean of 3.214.

Table VI

Number of Students and Mean Application Scores for Males and Females by Grade Level in the Egg Harbor City School District

Grade	N	Female	Male
3	20	3.564	3.944
4	22	3.379	3.588
5	18	3.612	3.555
6	19	3.633	3.214
7	18	3.457	3.867
8	17	3.738	3.522

Hypothesis V states that there will be no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student. The mean scores were clustered into elementary and junior high levels by gender.

An Analysis of Variance was used to determine the deviation score. A "t" test was used to determine if a statistically significant difference existed between the application scores of the students. The .05 level was used to determine significance. The means and standard deviations of the scores of elementary level females and elementary males are presented in Table VII.

In Table VII, it can be seen that for males at the elementary level the mean application score was 3.776. The mean application score for females at the elementary level was 3.46. A "t" score of -1.265 was computed. The "t" value needed for significance at the .05 level was 2.120. This indicated that no significant differences existed between the two groups. Therefore, Hypothesis V was accepted. There were no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Table VII

"t" Test of the Differences Between Application Mean Scores for Males and Females at the Elementary Level

Gender	N	Mean	S D	"t"
Male	17	3.776	.498	
Female	25	3.46	.614	
				-1.265

Hypothesis VI states that there will be no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

The mean scores were calculated for male and female subjects at the junior high level. These scores were then used to do an Analysis of Variance to determine the deviation score. A "t" test was used to determine if a statistically significant difference existed between males and females at the junior high

level. The mean scores and standard deviations of the scores of junior high level males and females are presented in Table VIII.

In Table VIII, it can be seen that for males at the junior high level, the mean application score was 3.502. The mean application score for females at the junior high level was 3.632. A "t" score of -.833 was computed. The "t" value needed for significance at the .05 level was 2.028. This indicated that no significant differences existed between the two groups. Therefore, Hypothesis VI was accepted. There were no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table VIII

"t" Test of the Differences Between Application Means for Males and Females at the Junior High Level

Gender	N	Mean	S D	"t"
Male	43	3.502	.537	
Female	25	3.632	.393	
				-.883

Hypothesis VII states that there will be no significant differences in computer use between females at the elementary level and females at the junior high level as measured by the MSO Computer Survey - Student. The

mean scores were calculated for females at the elementary level and females at the junior high level. These scores were then subjected to an Analysis of Variance to determine the deviation score. A "t" test was used to determine if a statistically significant difference existed between the females at the elementary level and the females at the junior high level. The means and standard deviations of the application scores of elementary level females and junior high level females are presented in Table IX.

In Table IX, it can be seen that for females at the elementary level, the application mean was 3.46. The mean application score for females at the junior high level was 3.632. A "t" score of -1.246 was computed. The "t" value needed for significance at the .05 level was 2.064. This indicated that no significant difference existed between the two groups. Therefore, Hypothesis VII was accepted. There were no significant differences in computer use between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table IX

"t" Test of the Differences Between Application Means for Females at the Elementary Level and Females at the Junior High Level

Level	N	Mean	S D	"t"
Elementary	25	3.46	.614	
Junior High	25	3.632	.393	
				-1.246

Hypothesis VIII states that there will be no significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

The mean scores were calculated for male subjects at the elementary level and male subjects at the junior high level. These scores were then used to do an Analysis of Variance to determine the devation score. A "t" test was done to determine if a statistically significant difference existed between males at the elementary level and males at the junior high level. The means and standard deviations of the application scores of elementary level males and junior high level males are presented in Table X. In Table X, it can be seen that for males at the elementary level, the mean application score was 3.776. The mean application scores for males at the junior high level was 3.502. A "t" score of 3.033 was computed. The "t" value needed for significance at the .05 level was 2.120. This indicated that a significant difference existed between the two groups. Therefore, Hypothesis VIII was rejected. There were significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Table X

"t" Test of the Differences Between Application Mean Scores for Males at the Elementary Level and Females at the Junior High Level

Level	N	Mean	S D	"t"
Elementary	17	3.776	.498	
Junior High	43	3.502	.537	
				3.033

The MSO Computer Survey -Student asked the respondents to identify the subjects for which they used computers. Table XI shows the subjects for which males and females in the Egg Harbor City School District use computers.

In Table XI, it can be seen that Math, Reading, and Writing were the top three subjects chosen by both males and females. Eighty-three percent of the females surveyed chose Math, 58% chose Reading, and 56% chose Writing. For males, 73% chose Math, 55% chose Writing, and 53% chose Reading.

Table XI

Percentages of Computer Use in Subject Areas by Females and Males

Subject	Female	Male
Math	83%	73%
Social Studies	20%	20%
Spelling	22%	31%
Art	37%	36%
Library	31%	31%
Music	14%	20%
Phys. Ed.	10%	11%
Science	39%	36%
Writing	56%	55%
Reading	58%	53%

Gender bias questions on the MSO Computer Survey - Student were scored and the mean scores were calculated. A high score meant that the students were biased or had a tendency to stereotype towards their own sex based on their responses. The total population mean scores are presented in Table XII.

In Table XII, it can be seen that the lowest gender bias score for males was seventh grade with a mean gender bias score of 2.9. The highest gender bias score for males was sixth grade with a mean score of 3.2.

For females, the lowest gender bias score was 2.8 in sixth grade. The highest gender bias mean score was 3.7 in third grade.

Table XII

Number of Students and Mean Gender Bias Scores for Males and Females in the Egg Harbor City School District

Grade	N	Male	Female
3	20	3.0	3.7
4	22	2.9	3.2
5	18	2.9	3.0
6	19	3.2	2.8
7	18	2.8	3.1
8	17	2.9	2.9

The illustration of the "computer expert" was a means to obtain information on how students view computer experts. Drawings were reviewed and tabulations were made as to whether the "computer expert" illustration was male, female, or neutral. Male features were those illustrations that contained a person with short hair, pants, pocket protector, briefcase, glasses, sports logos, "mad" scientist look, etc. Female features were long hair, face makeup, long eyelashes, jewelry, or pocketbook. Notes were made as to significant features in the drawing that further identify the "computer expert" as a "math whiz", "hacker", or unpopular "nerd."

Table XIII shows the data collected from the females' illustrations. It can

be seen in Table XIII, that more females draw female "computer experts" in grades 3 - 7. In eighth grade, however, there are no instances of females in the illustrations. In fifth and seventh grades, the percentage of difference is greatest in favor of female "computer experts." In fifth grade, 75% of the illustrations showed female experts compared to 25% showing male experts. In seventh grade, 67% of the illustrations show female experts compared to 33% showing male experts.

Table XIII

Percentage of Male, Female, and Neutral Computer Experts Identified in Females' Illustrations in Grades Three through Eight

Grade	Male Features	Female Features	Neutral Features
3	36%	55%	27%
4	43%	50%	14%
5	25%	75%	0%
6	42%	50%	17%
7	33%	67%	0%
8	88%	0%	13%

Table XIV shows the data collected from the males' illustrations. From Table XIV, it can be seen that for all grade levels surveyed, three through eight, male computer experts were more prevalent in the illustrations than female computer experts.

In third grade, 44% of the males drew female computer experts, the same percentage, 44%, drew male computer experts. In the fourth and sixth grade, 100% of the drawings featured male computer experts.

Table XIV

Percentage of Male, Female, and Neutral Computer Experts Identified in Males' Illustrations in Grades Three through Eight

Grade	Male Features	Female Features	Neutral Features
3	44%	44%	22%
4	100%	0%	0%
5	73%	18%	18%
6	100%	0%	0%
7	89%	11%	0%
8	89%	0%	11%

Another analysis of student's perceptions of stereotypical careers was done using the MSO Computer Survey - Student. Question #20 asked the male and female subjects to select the best careers for girls. Responses of "Agree" or "Strongly Agree" for each career were tallied and a percentage was calculated for each. The same procedure was used for Question # 21 which asked which careers were best for boys. Selections from which the subjects could choose from can be found in the MSO Computer Survey - Student in

Appendix A. For purposes of this study, only the responses for computer repairperson, computer software designer, computer games specialist, computer salesperson, and math and science teacher will be presented in Tables XV, XVa., XVI, and XVIa.

In Tables XV and XVa., it can be seen that males' percentage of agreement was low for computer-related fields when selecting best careers for girls. Females also had a lower percentage of agreement for computer-related fields when selecting best careers for girls. Both males and females had a higher percentage of agreement for the selection of "math teacher."

Table XV

Male "Agree" and "Strongly Agree" Response Percentages to Survey Question #20 on Best Careers for Girls on the MSO Computer Survey - Student

Career	3rd	4th	5th	6th	7th	8th
Math Teacher	33%	63%	55%	57%	67%	33%
Computer Repairperson	33%	25%	9%	0%	22%	33%
Computer Software Designer	33%	88%	9%	43%	56%	67%
Science Teacher	22%	38%	45%	29%	33%	33%
Computer Games Specialist	33%	75%	9%	14%	22%	56%
Computer Salesperson	22%	38%	18%	43%	33%	22%

Table XVa

Female "Agree" and "Strongly Agree" Response Percentages to Survey Question # 20 on Best Careers for Girls on the MSO Computer Survey - Student

Career	3rd	4th	5th	6th	7th	8th
Math Teacher	73%	71%	88%	58%	89%	66%
Computer Repairperson	9%	29%	13%	8%	22%	13%
Computer Software Designer	36%	36%	50%	58%	67%	63%
Science Teacher	27%	79%	38%	42%	56%	38%
Computer Games Specialist	45%	36%	38%	58%	56%	63%
Computer Salesperson	18%	21%	50%	25%	33%	63%

Question # 21 asked the respondents to select the best careers for boys. These results can be seen in Tables XVI & XVIa. In Table XVI & XVIa, computer repairperson and computer salesperson were more favorable careers for boys than for girls at all grade levels. Computer software designer showed that it was a career more favorable for girls than boys at the sixth and eighth grade levels. The area of computer games specialist showed that this was the best career for girls than for boys at the third grade level.

Table XVI

Male "Agree" and "Strongly Agree" Response Percentages to Survey Question #21 on Best Careers for Boys on the MSO Computer Survey - Student

Career	3rd	4th	5th	6th	7th	8th
Math Teacher	33%	50%	36%	29%	22%	56%
Computer Repairperson	33%	88%	73%	100%	67%	56%
Computer Software Designer	44%	63%	73%	71%	78%	67%
Science Teacher	33%	88%	64%	100%	78%	67%
Computer Games Specialist	33%	88%	73%	100%	100%	67%
Computer Salesperson	44%	63%	45%	100%	78%	56%

Table XVIa

Female "Agree" and "Strongly Agree" Percentages to Survey Question # 21 on Best Careers for Boys on the MSO Computer Survey - Student

Career	3rd	4th	5th	6th	7th	8th
Math Teacher	36%	64%	38%	58%	67%	13%
Computer Repairperson	45%	57%	63%	75%	100%	75%
Computer Software Designer	36%	43%	50%	42%	78%	38%
Science Teacher	9%	79%	63%	58%	100%	63%
Computer Games Specialist	27%	50%	50%	75%	89%	75%
Computer Salesperson	36%	50%	50%	58%	78%	63%

Summary of the Findings

From the results of the statistical and descriptive analyses, it can be seen that there were no significant differences in attitudes towards computers between male and female subjects at the elementary level. As a result, Hypothesis I, which states that there will be no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student, was accepted.

Statistical analysis showed no significant differences in attitudes towards computers between males and female subjects at the junior high level. Therefore, Hypothesis II, which states that there will be no significant differences in attitudes towards computers between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student, was accepted.

Statistical analysis showed significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level. As a result, Hypothesis III, which states that there will be no significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Conputer Survey - Student, was rejected. Females at the junior high level had a more positive attitude towards computers than females at the elementary level.

Statistical analysis showed significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level. Therefore, Hypothesis IV, which states that there will be no

significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student, was rejected. Males at the junior high level had a more positive attitude towards computers than males at the elementary level.

Statisitical analysis showed no significant differences in computer use between male and female subjects at the elementary level. Therefore, Hypothesis V, which states that there will be no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student, was accepted.

Statistical analysis showed no significant differences in computer use between male and female subjects at the junior high level. Therefore, Hypothesis VI, which states that there will be no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student, was accepted.

Statistical analysis showed no significant differences in computer use between female subjects at the elementary level and females at the junior high level. As a result, Hypothesis VII, which states that there will be no significant differences in computer use between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student, was accepted.

Statistical analysis showed significant differences in computer use between males at the elementary level and males at the junior high level. Therefore, Hypothesis VIII, which states that there will be no significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer

Survey - Student, was rejected. Males at the elementary level had higher levels of computer use that males at the junior high level.

Analysis of the subjects for which males and females use the computer showed that both males and females used the computer most for math. Seventy-three percent of the males used computers for math. Eighty-three percent of the fermales used the computer for math. The lowest percentage for an academic subject was social studies. Both males and females, with 20%, chose social studies as a subject for which to use computers.

The MSO Computer Survey - Student responses for the gender bias portion of the survey showed that males at the sixth grade level had the highest gender bias score meaning they showed a greater tendency for stereotyping. Females at the third grade level had the highest gender bias score. This showed that they had a greater tendency for stereotyping. Males at the seventh grade level had the lowest gender bias score representing a low tendency for stereotyping. Females at the sixth grade level had the lowest gender bias score.

The illustrations of a "computer expert" showed that females drew females for grades three through seven except for the eighth grade in which 88% drew males. Males drew males for all grade levels.

Analysis of best career selections for boys and girls showed that for all grade levels, computer-oriented careers were best for boys than for girls. Math and science teacher careers were best for boys based on males' responses to the MSO Computer Survey - Student, females responded at all grade levels except third grade where girls were favored, that boys would also be best in math or science teaching careers.

Chapter Five

Conclusions and Recommendations

Summary of the Problem

This study attempted to determine the grade level at which attitudes towards computers begin to change. Areas of gender bias and application were also studied since they are influential in shaping attitudes.

Summary of the Method of Investigation

A review of the previous literature pertinent to this study was made. Specific hypotheses were formulated.

Students in the Egg Harbor City School District in Egg Harbor City, New Jersey were selected for this study based on the researcher's access. A total of 103 students in grades three through eight comprised the sample. There were 42 males and 61 females surveyed.

The instrument used in this study, the MSO Computer Survey - Student, was designed specifically for this study.

The MSO Computer Survey - Student was administered to all 103 students by their classroom teachers. Test administration and data collection was conducted over a two week period.

To determine if there were significant differences in attitudes towards computers and use of computers between males and females at the elementary and junior high levels, Analysis of Variance was used. A "t" test was used to determine if any differences did exist for all hypotheses. Significance was set at the .05 level of confidence.

On the basis of the findings, a number of conclusions and recommendations were formulated regarding attitudes towards computers , computer use, and student's gender bias and it's relationship to computer activities.

Conclusions and Implications

Hypothesis I states that there will be no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Statistical analysis determined no significant differences existed between the two groups. Therefore, Hypothesis I was accepted. There were no significant differences in attitudes towards computers between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Even though the statistical analysis showed no significant differences, a downward trend in attitudes towards computers is apparent among males beginning at the third grade. A sharp increase in attitude score appears in the seventh grade. This may be due to the fact that the seventh grade surveyed was involved in a telecommunications project using new Macintosh computers and modems.

Sixth grade had the lowest attitude score. This may be due to the fact that the new teacher admittedly did not expose her students to the computers until a week before the survey was administered.

Females' attitude scores were lowest at the elementary level. However, junior high scores were high and remained high through the eighth grade. This may be due to the fact that the junior high places great emphasis on computer

interactions. The computer manager for the junior high building is active in exposing both students and teachers to different computing activities.

Hypothesis II states that there will be no significant differences in attitudes between the male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis determined that no significant differences existed between the groups. Therefore, Hypothesis II was accepted. There were no significant difference in attitudes towards computers between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Female's attitudes towards computers at the junior high level are higher than males at the junior high level. This may be signaling a positive change in promoting positive attitudes towards computers at the junior high level.

Hypothesis III states that there will be no significant differences in attitudes towards computers between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis determined that significant differences existed between the two groups. Therefore, Hypothesis III was rejected. There were significant differences between female subjects at the elementary level and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Females at the junior high level had a higher attitude score than females at the elementary level. Further study could determine if the present elementary females will have a more positive attitude towards computers when they enter the junior high building.

Swadener and Jarrett's (1984) study showed that girl's attitudes towards computers begin to change at about the fourth grade level. This study showed a change at the fifth grade level, however it was a positive change. Females exhibited more positive attitudes towards computers.

Hypothesis IV states that there will be no significant differences in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis indicated that a significant difference existed between the variance of these groups. Therefore, Hypothesis IV was rejected. There was a significant difference in attitudes towards computers between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Males at the elementary level had a higher attitude score compared to males at the junior high level. Computing equity among boys and girls at the elementary level could account for the higher scores for males.

Hypothesis V states that there will be no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Statistical analysis indicated that no significant differences existed between the two groups. Therefore, Hypothesis V was accepted. There were no significant differences in computer use between male and female subjects at the elementary level as measured by the MSO Computer Survey - Student.

Male application scores showed a downward trend similar to the trend exhibited in attitude scores. A sharp increase appeared again at the seventh grade level. This may be due to the fact that this class was involved in a

telecommunications project. Since both attitude and application scores were high at the seventh grade level at which telecommunications was being used may lend itself to further discovery.

Female scores for application were lowest at the fourth grade level. There was an increase in fifth and sixth grade, but a sharp decline in seventh grade. Since the males' scores were much higher in this area, this could be caused by males monopolizing the telecommunications project.

Hypothesis VI states that there will be no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis indicated that no significant differences existed between the two groups. Therefore, Hypothesis VI was accepted. There were no significant differences in computer use between male and female subjects at the junior high level as measured by the MSO Computer Survey - Student.

Based on the fact that the junior high school had computer network problems, teachers would have to be knowledgeable about the stand-alone software. Many of the teachers are more comfortable using the network rather than searching for stand-alone disks. This could account for the scores being relatively close between males and females.

Hypothesis VII states that there will be no significant differences in computer use between females at the elementary level and females at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis indicated that no significant difference existed between the two groups. Therefore, Hypothesis VII was accepted. There were no significant differences in computer use between female subjects at the elementary level and female subjects at the junior high level as measured by

the MSO Computer Survey - Student.

Similar to the attitude scores, females at the junior high level exhibited more computer use than females at the elementary level.

Hypothesis VIII states that there will be no significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

Statistical analysis indicated that a significant difference existed between the two groups. Therefore, Hypothesis VIII was rejected. There were significant differences in computer use between male subjects at the elementary level and male subjects at the junior high level as measured by the MSO Computer Survey - Student.

The downward trend was similar to the trend in attitude scores. Males in third through sixht grade had lower application scores. A sharp increase was evident in the seventh grade. This may be due to the fact that seventh grade males were involved in a telecommunication project.

The analysis of which subjects males and females used computers shows that academic subjects are the primary use for computers. This may be due to teachers' knowledge and implementation. More creative use of computers needs to be integrated into the classroom. Students expressed how the computers and software are old. Most of the software being used was drill and practice.

Similar to Barba and Mason's study (1992), students drew a "computer expert". The findings showed that males starting at the fourth grade level drew more "experts" as males than females. Females, on the other hand, drew more female "experts" than males except at the eighth grade level when 88% of the females drew male "computer experts". However, at the fifth through seventh

grade levels, females at times drew a protrait of the school's female computer manager. This may lend itself to having more women as computer managers to provide females with a computing role model.

Based on responses of which careers are best for girls or boys, it was found that careers that have the word "computer" in it tended to be more appropriate for boys than girls. This appeared at all grade levels. Based on the research done prior to the study, it appears that students are still biased in their views of computer careers. It still appears to both males and females to be a male domain.

Recommendations for Further Study

The following recommendations are based on the findings of this study:

1) A longitudinal study of this population should be conducted to see if the attitudes change as the the students get older.

2) A study on teacher's attitudes, application, and gender bias towards computers should be conducted to see if they correlate with the general population of the sample.

3) A study on how and if student's perceive their teachers as computer experts should be conducted.

4) Improvement of the survey, particularly questions #20 and #21, should be done in order to track male and female responses more efficiently.

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Appendices

Appendix A
MSO Computer Survey - Student

MSO Computer Survey - Student

Grade: (please circle) 3 4 5 6 7 8

Sex: (please circle) Female Male

Instructions: Place an "X" in the column that best describes your feelings about each statement.

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1.	Girls like to work on the computer with a partner.					
2.	I would rather work alone on the computer.					
3.	Boys are better at computer games that require skill.					
4.	Girls are better at computer games that involve solving problems.					
5.	I like computer programs that require "quick hands" on the keyboard.					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
6.	The computer programs that are best for girls are:					
	AppleWorks					
	Math Mansion					
	Print Shop					
	Logo (turtle graphics)					
	Skills Bank					
	Wheel of Fortune					
	Reader Rabbit					
	Matterhorn Screamer					
	Tom Sawyer					
	Writer Rabbit					
7.	I feel good when I am working on the computer.					
8.	I can only use the computer when I am good in class.					
9.	I like to create things like cards and banners on the computer.					
10.	Computers are very useful in the classroom.					
11.	I get frustrated when working on the computer.					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
12.	Having a computer at home would help me with my homework.					
13.	I use the computer in the classroom:					
	once a week					
	2-3 times a week					
	once a month					
	rarely					
14.	I don't think computer skills are necessary to get a job.					
15.	I have a Sega/Nintendo system at home.					
16.	I play with my Sega/Nintendo system:					
	once a week					
	2-3 times a week					
	every day					
	once a month					
17.	I would rather do math problems on the computer than work out of the textbook.					
18.	I would rather do reading work on the computer than do worksheets or read stories.					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
19.	You have to be good at math to learn about computers.					
20.	The following careers are best for girls:					
	Doctor					
	Math Teacher					
	Computer Repairperson					
	Computer Software Designer					
	Reading Teacher					
	Nurse					
	Science Teacher					
	Secretary					
	Computer Games Specialist					
	Computer Salesperson					

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
21. The following careers are best for boys:					
Doctor					
Math Teacher					
Computer Repairperson					
Computer Software Designer					
Reading Teacher					
Nurse					
Science Teacher					
Secretary					
Computer Games Specialist					
Computer Salesperson					
22. The computer programs that are best for boys are:					
AppleWorks					
Math Mansion					
Print Shop					
Logo (turtle graphics)					
Skills Bank					
Wheel of Fortune					
Reader Rabbit					

Matterhorn Screamer					
Tom Sawyer					
Writer Rabbit					

23. I use the computer in the following subject areas:

Math					
Social Studies					
Spelling					
Art					
Library					
Music					
Phys. Ed.					
Science					
Writing					
Reading					

24. I am using the computer more this year than last year.

25. Using the computer has made me smarter.

26. Girls are quieter than boys when working on the computer.

27. Computers make me feel stupid.

28. Girls are faster at typing than boys.

29.	Boys don't share the computer easily.	_____	_____	_____	_____	_____
30.	I would like to have my own computer at home to play computer games.	_____	_____	_____	_____	_____
31.	I help others with problems on the computer.	_____	_____	_____	_____	_____
32.	Girls can be successful in jobs that require computer skills.	_____	_____	_____	_____	_____
33.	I would rather type stories on the computer than use paper and pencil.	_____	_____	_____	_____	_____

On the back of this page, draw a "computer expert"

Appendix B
MSO Computer Survey - Teacher

MSO Computer Survey - Teacher

Grade Level (s) I teach: (please circle) 3 4 5 6 7 8

Sex: (please circle) Female Male

Instructions: Place an "X" in the column that best describes your feelings about each statement.

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1.	The students who spend the most time on the computer are boys.					
2.	I don't see the need for computers in the classroom.					
3.	I learned to use the computer:					
	on my own					
	from a friend					
	college courses					
	inservice training					
	other					
4.	I have a computer at home.					
5.	A person with strong mathematical aptitude will learn computers quickly.					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
6.	Putting students on the computer is distracting.					
7.	I consider myself proficient at computers.					
8.	Girls would rather talk with their friends than play computer games.					
9.	I expose my students to a variety of software.					
10.	I am always trying to find ways to incorporate technology in my lessons.					
11.	I am good at troubleshooting technical problems on the computer.					
12.	The student I consider to be the computer "expert" is male.					
13.	Boys are aggressive on the computer.					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
14.	Using the computer has made my life easier.	_____	_____	_____	_____	_____
15.	In order to teach computers, I would need to take a lot of math courses.	_____	_____	_____	_____	_____
16.	I show my students how a computer is helpful in everyday life.	_____	_____	_____	_____	_____
17.	I use the computer software guide to select appropriate software for my lessons.	_____	_____	_____	_____	_____

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
18. Which of the following subject areas do your students use computers for:					
Math					
Social Studies					
Spelling					
Art					
Library					
Music					
Phys. Ed.					
Science					
Writing					
Reading					
19. The girls that I would encourage to take computer courses would be those with strong mathematical ability.					
20. If my computer has a technical problem, I am afraid to try to fix it.					
21. I use the computer for the following applications:					
spreadsheet					
word processing					
database					

		Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
22.	Boys like software that involves battles and destruction.					
23.	The boys in my class monopolize the computers.					
24.	I would be happy if they moved my computers out of my room.					
25.	I feel comfortable teaching others about the computer.					
26.	Girls like software that is creative and open-ended.					
27.	I am using the computer more this year than last year.					
28.	In my classroom, time on the computer is used as a reward.					
29.	Boys are more apt to play math games than type stories on a computer.					
30.	Girls are more apt to like word processing than computer math games.					

On this page, draw a "computer expert"

Biographical Data

Name:	Mary S. O'Sullivan
Date and Place of Birth:	October 18, 1963 Camden, New Jersey
Elementary School:	Barclay School Cherry Hill, New Jersey
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Undergraduate School:	Glassboro State College Glassboro, New Jersey
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