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Increasing Elementary School Teachers' Awareness of Gender Inequity in Student Computer Usage

Nicole LUONGO *

Saint Peter's University, United States

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Abstract

This study was designed to increase gender equity awareness in elementary school teachers with respect to student computer and technology usage. Using professional development methods with a group of teachers, the writer attempted to help them become more aware of gender bias in technology instruction. An analysis of the data revealed that teachers who were exposed to gender equity professional development training sessions were more likely to exhibit gender equitable teaching behaviors than they did prior to the sessions. The data also indicated that teachers provided more equitable assistance to their classroom students after being presented with gender equity interventions.

Keywords: Technology, Gender, Bias, Elementary

Introduction

After the ratification of Title IX of the Education Amendments of 1972, America's elementary schools have been mandated to provide equal educational opportunities for both girls and boys (Shapiro, Kramer & Hunerberg, 1981). Title IX stated, "No person in the United States shall on the basis of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance" (Sec. 1681). According to American Association of University Women (AAUW) Educational Foundation (1992), even with Title IX of the Education Amendments of 1972 guidelines, teachers and school administrators often struggle with the law and its regulations.

This study examined the attitudes of teachers regarding gender and technology in the elementary school. Title IX of the Education Amendments of 1972 produced parameters that

* Nicole Luongo, *Saint Peter's University*, 2641 John F. Kennedy Boulevard , Jersey City, NJ 07306, United States Phone: +12017616187. E-mail: nluongo@spc.edu.

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educators are required to follow help prevent gender discrimination (AAUW Educational Foundation, 1992). The study connected those boundaries to the fields of technology and technology education in a school in the state of New Jersey. The school involved in this study is a public institution located in a suburban middle-class section of northern New Jersey.

Statement of the Problem

The problem that this study addressed was that primary-level teachers in the school district were not providing equal or equivalent technology experiences to both genders. Previous research (Sanders, Koch & Urso, 1997) suggested that male and female students are on the same level in terms of technology ability and usage until middle school but, thereafter, the abilities of male students surpass that of the female students. This study, therefore, examined whether teacher attitudes from the primary years had any effect on the computer usage of boys and girls in elementary school.

Through informal interviews, the writer found that the teachers in this elementary school agreed that primary-level teachers in the school district did not provide equal or equivalent technology experiences for both genders. Several of the teachers admitted that they often favored the male gender in using educational technology.

Furthermore, several teachers found that even as early as elementary school, the girls did not choose to use computer technology in school projects as often as did the boys. Some of the participating teachers claimed that the female students selected traditional methods of learning and research over technological approaches because they did not have as much access to or experience with computer technology as did the male students.

The study was conducted in a kindergarten to Grade 8 school district located in a suburban, middle class section of New Jersey. The town has a population of 6,473 individuals (U.S. Census, 2000). Of these individuals, 49% are male and 51% are female. At the time of this study, the socioeconomic status of the average resident was middle class with 74.9% of the residents in the U.S. work force.

In the school district, there is one elementary school that accommodates prekindergarten through third-grade students and one middle school that provides educational services to fourth-grade through eighth-grade students. At the time of the study, there were approximately 615 students enrolled in the school district with 290 in the selected school.

The two schools in the school district have been wired for the Internet. In fact, all classrooms have Internet access and are equipped with at least two computers for student use. An underground fiber-optic line connects the two schools and the administration building. The school district encourages teachers to incorporate the use of technology into their instruction; the teachers are often provided with professional development opportunities to successfully infuse technology into the curriculum.

When this study was conducted, the school district staff consisted of 60 teachers, 1 superintendent, 1 middle school principal, 1 elementary school principal, 1 library media specialist, and 1 technology coordinator. The library media specialist did not teach computer technology. The technology coordinator worked 4 days a week and provided computer instruction for the second- and third-grade classes. There was 1 full-time technology teacher who provided computer instruction to all fourth- to eighth-grade students.

The purpose of this project was to increase teacher gender equity awareness levels with respect to student computer technology usage. Additionally, the writer aimed to help teachers become aware of gender bias in technology instruction and to provide a more gender equitable approach to technology usage.

The administration of the school district and the school district's technology committee argued that the abovementioned technology improvements allowed teachers to provide all students with an equitable high-quality technology education. Moreover, the administration provided much encouragement to teachers who participated in technology training and implemented its use into their teaching. The administration urged teachers to use technology in their teaching, but it was not obligatory. With these accessible technological opportunities, teachers should have been able to provide equal or equivalent technology educational experiences to all students--but were they? The writer's purpose in this project was to increase the teacher gender equity awareness to meet these goals.

Research Questions

This study examined several gender and technology-related questions. These questions guided the study, and were reviewed and reevaluated during the course of the study:

1. Did the teachers and students perceive that all students had equal and adequate access to the classroom computers?
2. What were the teachers' attitudes regarding gender and educational ability?
3. Did the teachers' attitudes regarding gender correlate with the provisions they made for technology use in their classrooms?

Methods

The study involved a general group of 20 elementary school teachers, some of whom were later selected as a sample group of teachers who were directly involved in the study. It also involved the 80 elementary school students from the classes of the participating teachers. The selected group of teachers was identified by means of a preliminary questionnaire. After the 20 teachers completed the questionnaire, the writer randomly chose one teacher from each grade level in the school from kindergarten through third grade by placing the names into a pool and choosing them without preference. In Table 1, the number of students in each of the selected teachers' classes is displayed.

Table 1. *Number of Students From the Selected Teachers' Classes*

Teacher	*No. of students*
Kindergarten	19
Grade 1	18
Grade 2	23
Grade 3	20

The target population for the study included all teachers in the school (Gall, Borg & Gall, 1996). The study then utilized an *accessible population,* which was a practical option of using individuals who could realistically be included in the sample. The general group of teachers was classified as those teachers who replied to the initial questionnaire. Gall et al. explained that a *convenience sample* is a group of cases that are selected simply because they are available and accessible. A convenience sample group of four teachers was selected from within this general group, which became the selected sample group of teachers for the study.

The student population included all of the students in the classes of the selected sample group of participating teachers in the study. In order to choose students for the focus groups, the writer randomly selected students from the population by using a systematic sampling procedure. A list of all students in the population was created. Then, the population of students was divided by four, which was the number needed for the sample (Gall et al., 1996). Next, the writer selected the students and distributed permission slips to them. The permission slips were photocopied and handed to the children's homeroom teachers to be distributed. All of the children in the selected classes returned the permission slips. The children who returned the permission slips were placed into a group of participants.

Instrument

The quantitative research measure that was used in this study was the questionnaire, and was accompanied by a cover letter. The purpose of the questionnaire was to obtain information about all the teachers in the school, their technology backgrounds, and their views of gender and technology.

The study included one computer laboratory observation of the selected sample group of teachers and their students before the intervention and one after the intervention. The school computer laboratory was the location of each observation during the teacher's scheduled technology period. The writer measured the amount of time the teachers spent with girls and with boys in connection with computer technology education.

During these observation periods, the writer acted as a complete observer and maintained what Gall et al. (1996) called "a posture of detachment from the setting being studied"(p. 345). Structured observation methods were used to observe specific behaviors of the teachers regarding their treatment of the boy and girl participants. The writer used a quantitative, tailored observation system (Glickman, Gordon & Ross-Gordon, 1995) designed to collect these four specific types of behaviors:

1. How often the teacher assisted male students.
2. How often the teacher assisted female students.
3. How often the teacher provided positive feedback to male students and female students.
4. How often the teacher provided negative feedback to male students and female students.

An example of the observation instrument can be viewed in Figure 1.

The writer used this set of data to examine the patterns of the selected teachers in relation to their interactions with male and female students and their technology teaching behaviors. The data by analyzed by tallying the total number of instances of assistance to the female students and the total number of instances of assistance to the male students. The number of positive responses given to male students and compared that number to the number of positive responses given to female students were tallied. Likewise, the writer distinguished between the number of negative responses given to male students and the number of negative responses given to the female students. The analysis included a gender comparison of these variables.

B +++	G	B
B ---	G	G +
B ---	B	B
B ++	G +++	G
G ----	G +++++	G
B	B --	B
G	B ++--	G

Figure 1. Question-response observation instrument for measuring gender bias. B = boy, G = girl, = teacher assistance to student, - = positive response to student, + = negative response to student.

Additionally, the writer conducted individual semistructured confirmation survey teacher interviews with the four selected teachers before and after the intervention. An interview guide was used and, although it was structured, the interviewer was prepared to make any necessary modifications if the interview did not go as planned.

Furthermore, the writer used focus group interviews to examine student perceptions of gender equity in their teacher's instructional methods. The writer conducted four sets of focus group interviews. Each group was interviewed before and after the intervention.

Throughout the study, the writer monitored the four selected teachers in the computer laboratory completing the preintervention observations. The writer met with each participant before the observations to discuss appropriate observation times. The tailored question-response observation instrument for measuring gender bias was used to collect data on the gender-biased behaviors (see Figure 1).

Additionally, the writer interviewed each teacher and conducted the student focus groups at convenient times and places. After collecting the initial data, an action project was implemented in which the writer worked with the four selected teachers to promote gender equity in technology education. Rubin (2000) discussed certain strategies that could be used to transform attitudes toward gender stereotypes and behavior through school programs. There were three goals of the teacher intervention strategies:

1. To learn about gender neutral teaching strategies.
2. To learn about ways computers could support and enhance student learning.

3. To consider ways to use the available computer resources equitably in their classrooms.

Research (Lundeberg, 1997; Sanders, 2003b) documented intervention strategies that include the presentation of gender equity sessions. Four after-school workshops were conducted. Sanders explained that a one-shot workshop by itself is unlikely to do much. For the workshop to be effective, it must have a follow-up. Follow-ups can include multiple workshops and specific activities that occur as a result of the workshop.

When creating a gender equity workshop, Sanders (2003b) suggested using six rules: (a) prepare extensively, (b) be factual, (c) use no blame, (d) do not bash males, (e) demonstrate support, and (f) remember the What's In It for Me? rule. Sanders explained that the workshop must be relevant to the participant's concerns and it must demonstrate that there is a gender problem that needs to be addressed. Because a problem was established in the pretesting phase of the study, the writer was able to present this finding at the workshop.

During this time, the writer conducted four after-school gender equity sessions with the four selected sample group of teachers. These sessions presented gender equity and technology information to the teachers in order to improve their knowledge of gender equity and technology education.

After the intervention strategies were completed, the outcomes of the project were evaluated by reevaluating the attitudes of teachers and students. The questionnaire was administered to the general group of teachers, and compared the original questionnaire results with that of the subsequent one. The writer looked for a change in the responses of the participants.

The follow-up computer laboratory observations were conducted in the computer laboratory. The writer observed the selected sample group of teachers. The writer and teachers decided on appropriate observation times and discussed what lessons would be occurring during those time periods.

Additionally, the writer interviewed the selected sample group of teachers and students to see if they perceived a change in the teacher attitudes. During the interviews, the same questions in the initial interview were asked. The writer compared these findings to the initial results to see if a change had occurred.

Results & Discussion

The purpose of this study was to increase the study participants' awareness of gender-related issues in association with technology. The pretesting results had indicated that the teachers in the school district were not providing equal or equivalent technology experiences for both genders. In order to remedy this situation, the elementary school teachers were exposed to several gender equity intervention strategies. Based on follow-up interview and observational data, the intervention strategies had proved to be successful. It was found that the participating teachers in this study from all of the grade levels had made the effort of distributing equitable attention to the boys and girls. They understood the impact that their attitudes and behaviors regarding gender could have had in their classrooms and computer laboratories. In this study, several gender and technology-related questions were examined. The questions were divided into three main areas of interest: (a) technology access, (b) teacher attitudes regarding gender and technology, and (c) technology provisions and gender.

Technology Access

Three questions were asked on technology access:

1. Did the teachers and students perceive that all students had equal and adequate access to the classroom computers?
2. What were the teachers' attitudes regarding gender and educational ability?
3. Did the teachers' attitudes regarding gender correlate with the provisions they made for technology use in their classrooms?

The teacher questionnaire, the teacher interviews, the student interviews, and the intervention session discussions provided the data with respect to these questions. These data-gathering techniques allowed the writer to obtain information in a variety of ways to see if the verbal and written reactions corresponded with the actions of the teachers in the study. They provided an insight to the question of the student perceptions of technology access matching the teacher perceptions.

The general group of teachers who responded to the questionnaire and the selected sample group of teachers seemed to hold similar views at the initial data collection point. On the whole, the majority of the teachers in these two groups claimed that they were not satisfied with the amount of time given to technology use and the computer laboratory.

The teachers in the general group produced a variety of reasons why they were dissatisfied with the amount of time given to the use of technology. A first-grade teacher explained that the lack of use technology as much as was due to pressures and responsibilities of teaching. Another teacher explained there were not enough computers in the school for those students to have access when they were needed. A second-grade teacher claimed, "When I want to get into the lab, the schedule is usually full. Also, the computers and printers in my classroom are often broken and the help does not get here quick enough." One third-grade teacher contended that "there is not enough time in the day" to get all the students on the computers. Another third-grade teacher maintained, "I do not get to use the computers as much as I would like to. I just do not have enough time to use them."

Likewise, the selected sample group were displeased with the amount of time spent on technology. The kindergarten teacher claimed, "I would like to use the computers more with the children. It is very difficult to get my students logged on to the computers in the lab by myself; the children are just learning to spell their names." The first-grade teacher asserted, "I would love to have a formal computer class taught by a computer teacher." The third-grade teacher stated that that class did not get into the computer laboratory as much as is desirable.

On the other hand, there were several teachers in the general group who were content with the amount of time they spent using technology in the classroom and the computer laboratory. One third-grade teacher explained that "the students get 40 minutes of instruction and 30 minutes of practice," which that teacher claimed was enough time for those students. A first-grade teacher claimed having a belief that the additional time the technology director assigned for using the computer lab furnished adequate time for using technology.

Only one teacher in the selected sample group perceived satisfaction with the amount of time used in technology. The second-grade teacher maintained, "It does not dictate or control my lessons, but it adds to the learning." Regarding the computer laboratory, the same teacher explained, "There is so much to do in my classroom that for now, it allows me

to do what I want to do." That teacher explained that the technology adds to the class lessons, but is not necessary to all of that teacher's goals.

Many of the views and attitudes of the general group and selected sample group changed regarding technology after the intervention sessions were conducted. Although the general group of teachers did not take part in the intervention sessions, they did experience certain changes. These changes were focused on common technology issues, not necessarily gender issues. The selected sample of teachers took part in the intervention sessions, and experienced evident changes in their opinions specific to gender and gender equity.

The changes in the general group's opinions after the intervention sessions focused on common technology usage issues. A first-grade teacher from the general group explained that that teacher started using the interactive whiteboard in class lessons due to the professional development training that the school provided. Another first-grade teacher agreed that the training received from workshops has made that teacher more comfortable using the technology. A third-grade teacher explained that having an assigned time in the computer lab motivates the teacher and the students. Most of these teachers did not mention gender equity issues in their postintervention responses.

After the intervention sessions, the selected sample group's view changes were directed towards gender equity and technology access. The second-grade teacher in the sample group asserted, "I started using the lab more often this year because it was necessary to get all the kids on the computers." That teacher explained that all girls and all boys needed to get more access to technology through the process of this study. The first-grade teacher expressed an awareness of the gender inequity in the classroom. The third-grade teacher was interested in following up by making sure the future technology classes of that teacher were provided with equitable time and access.

During both rounds of student interviews, most of the students perceived that they did not have equal access to the computer. However, a single reason was not apparent. Each group of students gave a different reason why they did or did not have equal access to technology. The kindergarteners believed that the students who finish their morning snacks were the most likely ones to use the computers. The first-grade boys believed that their teachers got to use the computers the most of the time; the first-grade girls said it was equal within the class. Three of the second graders claimed that there was a specific male student who made use of the computers the most. One of the students explained that that male student needed remedial help. Although the third graders perceived that they were able to use technology equally, they were unable to give any reason for this explanation.

There was a correlation between the selected sample group of teachers' and students' views of technology access. On a whole, the teachers believed that they did not have sufficient access to technology. Likewise, the students did not feel they had enough access to technology. However, the percentage of students who were displeased decreased after the intervention sessions were completed. In the preintervention interviews, 69% of the students in all grades did not believe they had enough access to technology. In the postintervention interviews, the number of students decreased to 56% of students who believed they did not have enough access to technology.

Teacher Attitudes Regarding Gender and Technology

There were three questions asked concerning teacher attitudes on gender and technology:

1. Did the teachers and students perceive that all students had equal and adequate access to the classroom computers?

2. What were the teachers' attitudes regarding gender and educational ability?
3. Did the teachers' attitudes regarding gender correlate with the provisions they made for technology use in their classrooms?

The questionnaire, the teacher interviews, and the intervention session discussions collected information about the teachers and their attitudes about gender and gender bias. The initial and follow-up questionnaire results provided data regarding the teacher levels of perceived gender bias at both the preintervention and postintervention sessions (Best & Kahn, 1993). The teacher responses in the questionnaire provided the writer with data to rank them as possessing high, moderate, or low levels of perceived gender bias. Overall, the sample group of selected teachers involved in the intervention showed more of a change of attitude in terms of perceived gender bias than the general group.

Although some of the teachers involved in the intervention sessions initially claimed that their classes were free of gender bias, they discovered and admitted they were surprisingly mistaken. Through the discussions and activities that occurred during the intervention phase of the study, the selected sample group of teachers realized that they did possess certain gender biases that they exhibited in their classrooms and the computer laboratory. They claimed that they often provided more assistance to the boys for a variety of reasons. The most popular reason given by the teachers during the interviews and informal discussions was the aggressive nature of boys. The teachers explained that boys often call out more often and seek assistance from the teacher; the girls are more passive and wait for the teacher to approach them.

The results of the preintervention computer laboratory observation of the selected sample of teachers can be viewed in Table 2. The writer collected data on the number of male and female students as well as the number of times the assisting teacher gave positive or negative responses to each gender. The writer calculated the results to show the total number of assists for each gender, which can be seen in Table 3.

Table 2. *Computer Laboratory Preintervention Observation Data*

Category	Kindergarten	Grade 1	Grade 2	Grade 3	Total
No. of students					
Girls	9	6	10	9	34
Boys	10	11	10	13	44
Teacher assistance					
Girls	8	10	17	1	36
Boys	19	15	20	11	65
Positive responses					
Girls	1	2	3	1	7
Boys	11	3	8	3	25
Negative responses					
Girls	0	1	0	7	1
Boys	1	7	7	5	20

At the conclusion of the intervention sessions, the writer observed the selected sample group of teachers in the computer laboratory. The writer collected data with respect to the

number of male and female students and the number of times the assisting teacher gave positive or negative responses to each gender. The results of the postintervention observation can be seen in Table 4. After tabulating the initial data, the writer calculated the results to show the total number of assists for each gender (see Table 3).

Table 3. *Total Number of Preintervention and Postintervention Responses by Gender*

	Responses of the girls		Responses of the boys	
Category	Preintervention	Postintervention	Preintervention	Postintervention
Kindergarten	9	31	27	26
Grade 1	13	25	32	34
Grade 2	20	35	15	17
Grade 3	2	19	19	21
Total	44	110	93	98

The intervention sessions that were conducted with the selected sample group of teachers presented information that added to the development of conclusions to the study. All of the computer professional drawings that the teachers created during the intervention sessions were of women. The students' drawings contained both female and male computer professionals. In Table 5, the division between male and female computer professional student drawings by grade level is provided. The drawings were divided according to gender; the teachers discussed specifics of what their children drew and the reasons behind the drawings.

During the second intervention session, the writer shared the data that was obtained from the computer laboratory observations (see Table 2) with the selected sample of teachers. The teachers and the writer discussed the statistics as well as the reasons behind the results. This meeting provided all teachers present with an opportunity to collaborate and examine the data.

Table 4. *Computer Laboratory Postintervention Observation Data*

Category	Kindergarten	Grade 1	Grade 2	Grade 3	Total
No. of students					
Girls	9	7	10	9	42
Boys	11	10	10	11	35
Teacher assistance					
Girls	12	18	7	8	45
Boys	11	22	8	8	49

Table 4 (Continue). *Computer Laboratory Postintervention Observation Data*

Category	Kindergarten	Grade 1	Grade 2	Grade 3	Total
Positive responses					
Girls	9	8	5	5	27
Boys	5	7	5	4	21
Negative responses					
Girls	6	6	3	6	21
Boys	10	5	4	9	28

During the third intervention session, the selected sample of teachers claimed to have had difficulty finding pictures of women using technology. The third-grade teacher found one picture of a woman using a cell phone; the second-grade teacher presented two pictures from a women's magazine with a woman using a laptop. The other teachers found no pictures. Collectively, the teachers agreed that the majority of technology advertisements and pictures in the media were focused on male consumers. Furthermore, this session's activity presented some information on how the teachers viewed girls and boys. The results of the activity can be seen in Table 6.

During the teacher interviews, the participating teachers were asked to describe the boys and girls in their classes using two adjectives. The descriptions the teachers in the study used to generalize the behaviors of students in their classes can be viewed in Table 7.

Table 5. *Division of Male and Female Drawings*

Teacher	Male	Female	Both
Kindergarten	14	3	1
Grade 1	5	11	0
Grade 2	6	9	0
Grade 3	10	30	1

Note. Total drawings of females were 35 and of males were 30; 1 drawing had both.

Technology Provisions and Gender

In addition to the questions regarding technology access, there were three questions dealing with technology provisions and gender:

1. Did the teachers and students perceive that all students had equal and adequate access to the classroom computers?
2. What were the teachers' attitudes regarding gender and educational ability?
3. Did the teachers' attitudes regarding gender correlate with the provisions they made for technology use in their classrooms?

From the completion of the questionnaire and the teacher interviews, information was collected about the teachers and the provisions they made for technology use. The student interviews and computer laboratory observations provided supplementary information for analysis.

Table 6. *Description of the Gender Description Activity*

Age	Descriptions of males (John)	Descriptions of females (Jane)
Infancy	Influenced by Mom. Plays with balls and trucks.	Influenced by Mom. Plays with dolls and bottle.
Nursery school	Influenced by Dad. Plays with blocks. Wears blue, green, or brown.	Influenced by teacher. Plays with Barbie. Wears a skirt
Elementary school	Influenced by Dad, teacher, and Mom. Draws, reads, and plays games. Wears whatever parents buy.	Influenced by friends and teacher. Reads and draws. Wears a skirt.
High school	Influenced by friends. Plays sports and with video games. Wears sweatpants.	Influenced by friends. Interested in jewelry. Wears a skirt.
College	Influenced by Mom, Dad, friends, and girlfriends. Plays with video games. Wears sweatpants.	Influenced by friends (boys and girls), and boyfriends. Interested in socializing. Wears a skirt.

Initially, the majority of both the general group of teachers and the selected sample group of teachers claimed that they provided equal or equivalent technology provisions for all students in their classrooms. The general group of teachers believed that gender did not play a part in their behaviors in the classroom. A second-grade teacher explained, "They use the computer when we go to the lab. There are no special provisions made for boys or girls." A first-grade teacher asserted that the children all had equal access to the technology in that room as well as the school. Many of the teachers claimed to have a procedure for assigning children to classroom and computer laboratory computers.

Table 7. *Teachers' Preintervention and Postintervention Description of Boys and Girls*

Category	Description of boys	Description of girls
Kindergarten		
Preintervention	Active an loud	Calm and sensitive
Postintervention	Talkative and active	Caring and kind
Grade1		
Preintervention	Loving and physical	Loving and centle
Postintervention	Loud and lively	Organized and calm
Grade 2		
Preintervention	Rowdy and loud	Quiet and worriers
Postintervention	Bright and enthusiastic	Obedient and interested
Grade 3		
Preintervention	Loud and rambunctious	Quiet and calm
Postintervention	Talkative and louder	Sensitive and quiet

Similarly, the selected sample group of teachers believed that they provided equal or equivalent provisions for boys and girls in their classes. The kindergarten teacher stated, "The children use the computers when we all go into the lab. They also rotate on the computers in

the classroom." The selected first-grade teacher agreed, adding that the children in that room followed a certain procedure that permitted them to take turns on the computers in the room.

During the preliminary round of interviews and questionnaires, the general group of teachers documented a variety of ways of how they selected children to use the computers in the classroom. One second-grade teacher explained the use of an alphabetical list of the students' names; the teacher checked off each name as each student used the computer. In first grade, two of the teachers asserted that the students used the computer to type their morning writing journals. Another first-grade teacher explained that teacher's procedure, "I use a new class list everyday. The student highlights his name when he begins a session of the software. Everyone has a turn." Several teachers maintained that students who required extra help used the computer to engage in educational games or certain software.

Likewise, the selected sample group of teachers acknowledged how they selected children to use technology in the classroom. The selected second-grade teacher explained that a rotating schedule had been set up in that classroom. The third-grade teacher maintained that students who finished their work were permitted to use the computer. The kindergarten teacher explained that the children used the computer during center time and free time.

Some of the teachers in the general group explained that it was difficult for all students to get equal time due to individual circumstances. One teacher claimed that students circulated through that classroom at different times. That teacher explained that this movement hindered the ability to ensure equal time to all students. Another teacher did not keep track of students on the classroom computers; they were allowed to use the computers when they were finished with other work. That teacher expressed concern over this inequality, but claimed to not know how to make it more equitable. The teachers in the selected sample group did not express difficulty in providing equal time to all students.

During the first round of interviews, none of the teachers in the selected sample believed that their attitudes about gender affected their students' beliefs. The participating second-grade teacher explained that attempts were made to be as fair in classroom as possible, but no matter what the attempts, the students used the computers at their own paces. This same teacher did not see any reason how the style of teaching the class could affect how the students perceived themselves. On the other hand, the kindergarten teacher was concerned not only with the way that the children were taught, but by the number of boys and girls in each class. That kindergarten teacher contended that when there were more boys than girls in a class, the focus turned to the boys. That teacher also believed that the girls were more likely to find alternate solutions when using the computers rather than asking the teacher. A first-grade teacher claimed that the class technology allotment was fair, but acknowledged that not every student used the computer daily. However, that first-grade teacher believed that it did not any affect how students perceived using technology or themselves.

During the computer professional drawing activity in the intervention session, all of the computer professional drawings that the teachers created during the intervention sessions were of women. The writer and the teachers discussed the reasons why they drew women. They explained that they thought of the school technology director who is female as well as other computer professionals that they knew. One of the teachers described a former roommate who was a computer technician. The group discussed the details of the drawings and concluded that in the past they would have probably drawn men. More recently, women have emerged as computer professionals. The writer concluded that the teacher views of gender were changing due to the strong emergence of women in the technology field.

The data that the writer collected regarding the students' computer professional drawings (see Table 5) was divided according to gender. During the second intervention session, the teachers discussed specifics of what their children drew and the reasons behind the drawings. The findings suggested that the students in these grades did not hold a strong view of a certain gender holding the profession of computer professional. Furthermore, there was no established difference between the boys' and girls' drawings.

The computer laboratory observations provided information about the teachers' behaviors towards using technology. This setting provided each student with an equal opportunity to use a computer. There were enough computers in the laboratory for each student to have access. The writer used the observation tool in Figure to track the number of times each teacher assisted the boys and the girls. In the original observation period, the teachers provided a total of 44 responses to the girls and 110 responses to the boys. In the follow-up period, the teachers provided a total of 93 responses to the girls and 98 responses to the boys. These numbers indicated that there was reduction in gender bias in the classroom.

During the intervention sessions and teacher interviews, the selected sample group of teachers discussed the behaviors of both boys and girls. The first-grade teacher explained that the boys are often more verbal about their needs, both in using technology and in other aspects of the classroom. The second-grade teacher claimed that girls will often sit and wait patiently while the teacher assisted the boys first. Throughout the intervention sessions, the teachers discussed that they were more aware of these aggressive male behaviors.

The follow-up interviews presented similar explanations for how the selected sample group of teachers delineated technology time among students in their classrooms. Most of the teachers had created or modified a procedure for students to follow in order to use computers. Some of the teachers mentioned that they were attempting to be less gender-biased in their educational technology approaches.

The general group of teachers noted some frustration with securing a successful system in providing equal opportunities for all students. One third-grade teacher explained, "I have students coming in and out of my room for a bunch of reasons. When they are not in my room all day, it is hard to fit in time for them to be on the computer." A second-grade teacher claimed, "I have not found a way to guarantee that all students have equal access to the computers."

After the intervention sessions were completed, the selected sample group of teachers' views and attitudes regarding gender changed. The general group did not change as dramatically. The selected first-grade teacher explained that there was an increased awareness of how personal attitudes and behaviors affected the children in the class. That first-grade teacher also noted the lack of female images in children's software as well as technology in general. The selected third-grade teacher explained that attempts had made to provide more equitable assistance and support to both the boys and the girls. That teacher also believed that if the school provided more computers, the students would have more access in general. Above all, all of the teachers who were involved in the professional development sessions noted a change in attitude toward gender and technology.

Based on the results of the second round of teacher interviews and questionnaires, the teachers agreed that all students, both male and female, had more equal access to technology than they did before they went through the professional development sessions. The teacher levels of awareness of gender equity were higher than they were before the intervention sessions. Some of the participants explained that they modified their selection procedures to be more gender equitable. One first-grade teacher acknowledged that classroom procedures and assistance attempts were meant to be fair, but that teacher could

now see how bias had been present in certain ways. The third-grade teacher agreed to use the tips that received during the training when planning for next year. Moreover, the teachers discussed how the aggressive nature of the boys as well as other factors can contribute to the unequal distribution of attention to the male students. Others found that their procedures were gender equitable and planned on continuing them.

In addition to the teacher attitudes, the writer examined the student attitudes towards the teachers who taught them. The writer used the student interview data to support the information that was gathered from the teachers. The writer examined several questions. How did girls and boys view technology? Did the students perceive that they all had equal access to the classroom computers? Why or why not? To answer these questions, the writer used the student group interview data.

The 16 students involved in this study viewed technology in a variety of ways. The preintervention interviews provided a base of what the students knew about technology and its connection to computers. The writer categorized the responses as ones that mentioned the term *computer* and ones that did not mention the term. During the preintervention interviews, 31% of students mentioned the term computer. When asked about technology, the kindergarteners and first graders were unsure of a definition for it. When asked what technology was, some of the students simply did not know; the others mentioned light. The second graders named some familiar forms of technology, such as computers, lights, cell phones, and other technologies. The third graders also named common forms of technology.

The percentage of students who referred to computers increased to 63% during the postintervention interviews. The follow-up interviews showed that the students were more aware of technology and its connection to computers. The majority of the student subjects in all grades acknowledged technology was related to computers. Some mentioned cell phones and lights, but the most common response for this section was computer-related.

In terms of whether or not they perceived themselves as having equal access to technology in the classroom and computer laboratory, the writer examined their responses to the interview question regarding who had the most access to technology in the classroom. The responses were coded in terms of whether they referred to a specific group or referred to the students being able to access technology in a fair and equitable manner. During the preintervention interview sessions, 31% of the students believed that they received equal access to technology. After the intervention sessions, 50% of the students perceived that they were provided with equal access to technology. Although some of the responses discussed other students, many of the replies focused on the teacher and how the teacher used the computer the most in the classroom.

Implications of Findings

Several implications can be made regarding teacher attitudes and perceptions of gender and technology. In this section, the same topics and questions that were presented in the previous chapter were focused upon: (a) technology access, (b) teacher attitudes, and (c) technology provisions.

One finding of the study was that neither the general group nor the selected sample group of teachers involved in the intervention was satisfied with the amount of time given to technology in the classroom or the computer laboratory. Both groups of teachers provided various reasons for why they were not satisfied. These reasons included time, space, lack of knowledge, and system requirements. Additionally, both the general group and selected

sample group of teachers who participated in the intervention showed changes in attitudes and perceptions on general technology usage during the study.

Although the study did not directly influence the number of computers present or the teacher access to the computer laboratory, both the general group and selected sample group of teachers claimed to be more satisfied with the amount of time they spent using technology at the end of the study. The reasons included (a) general professional development training sessions, (b) a higher number of computers present in the classrooms, and (c) more access to the computer laboratory. The technology coordinator explained that, during the course of the school year, there were several technology improvements that occurred in the school district. These upgrades included the addition of more computers in the classrooms and computer laboratory as well as the purchase of interactive whiteboards. Additionally, several technology training sessions for the teaching staff were also held.

The writer also found that the selected sample of teachers involved in the intervention believed that all students had more equal access to technology than they did before they had gone through the professional development sessions. Mainly, the teachers explained that the intervention sessions made them reconsider their gender biases as well as other biases and reconstruct how they provided student access to the available technology.

However, this finding did not isolate gender as the only variable in the increase of student access to technology. The general group and selected sample group of teachers explained that the increase in equity correlated with the fact that the teachers were more confident using technology, thereby, giving them the option to use it more in their teaching methodology. The teachers cited professional development opportunities and more practice opportunities as reasons behind their increased comfort using technology and infusing it into their teaching. The teachers explained that this ability to integrate technology into the curriculum provided more access to all students, not just boys or girls.

Additionally, the writer found that while many of the students perceived that they did not have equal access to the computers, gender bias was not the main reason behind the student perceptions of their teachers. They claimed the inequality related to areas, such as academic ability, speed in finishing work, and other factors. The student views towards their teacher's attitudes and perceptions did not seem to change after the intervention sessions were implemented. The view was the same for both boys and girls. However, this finding may have been skewed due to the young ages of the children involved in the study. Many of these children may not be developmentally prepared to comprehend their teacher's gender biases. The children viewed the access they had to computers and other forms of technology as not being correlated with their teacher's levels of gender bias.

The results of the questionnaire distributed at the beginning of the study showed that neither the general teacher group nor the selected sample group involved in the intervention were satisfied with the amount of time and training they received on the topic of technology. The results at the end of the study showed that there was a difference between the general teacher group and the selected sample group involved in the intervention in terms of the changes in attitudes and perceptions of gender and technology.

The selected sample group of teachers acknowledged that there were general similarities between the boys and girls in their classes. The first-grade teacher from the selected sample group asserted that both boys and girls were sensitive, inquisitive, anxious, loving, caring, and helpful. They also seemed eager to learn, but lacked patience and control. The second-grade teacher claimed that boys and girls both "love to come to school. They love to read and be read to. They like to draw pictures." The third-grade teacher claimed that boys and girls were similar in their math ability, but did not comment on their other abilities.

Conversely, the selected sample group of teachers identified that girls and boys had different qualities. The kindergarten teacher stated that girls tend to be more reserved in their responses while the boys are more outspoken. The first-grade teacher explained that boys tend to be more physical and aggressive. The second-grade teacher thought that the boys were more excited to use the computers than the girls. The third-grade teacher acknowledged that the children may possess equal academic skills, but often show different behaviors when working academically.

The selected sample group of teachers expressed some differences in the manner in which boys and girls utilized technology. The first-grade teacher saw that the boys wanted to play games on the computer while the girls enjoyed drawing and writing using a variety of educational software programs. The third-grade teacher observed that the boys tend to use sports games while the girls play games that deal with academics. The third-grade teacher explained that when there are more boys, that teacher tended to help them more frequently with academic tasks.

When the selected sample group of teachers was presented, during the second intervention session, with gender equity and technology statistics from earlier studies, they voiced concern about the dates of the study. The teachers discussed how they believed the statistics were outdated because women were then-currently being viewed as more acceptable in the world of technology. The writer discussed the years of the statistics and how things have revolutionized. The teachers agreed with the change, citing the fact that the main computer teacher and the main technology director in the school district were both female. The teachers agreed that females have made much progress in the field of technology. Moreover, the teachers predicted that females will become more prominent in the field in the future in the world of technology.

As a result of the intervention, the writer found that the selected sample group of teachers recognized to their surprise that they had held certain gender biases that they demonstrated in their classrooms and the computer laboratory. During the study, the attitudes and perceptions of the selected sample group of teachers had changed. Initially, these teachers claimed to teach in a gender equitable manner. After the intervention, they recognized and admitted that they did possess some gender bias in regards to technology.

With regard to the changes in attitudes and perceptions of gender and technology, there was a distinction between the general teacher group and the selected sample group that was involved in the intervention. The general group did not exhibit any specific changes in attitude regarding gender equity with the study. These teachers seemed to hold the same views of gender and technology before and after the study. Their unvarying attitudes could be attributed to the fact that they were not involved in the gender intervention sessions.

On the other hand, the selected sample group demonstrated identifiable changes in attitudes and perceptions of gender and technology in the postintervention data collection procedures. The general group's postintervention questionnaire responses were similar to the ones in the preintervention questionnaire. The selected sample group of teachers focused more specifically on gender as a construct in correlation with technology attitudes.

In the preintervention observation of the kindergarten class, there were three boys who received most (19) of the 31 responses. These three individuals received teacher assistance and positive responses. The teacher provided responses to 10 of the 11 boys; the teacher provided responses to 3 of the 8 girls. During the postintervention, all of the children except for one girl received responses. There were no students who seemed to receive more attention than others.

The preintervention observation of the second-grade class showed that there was 1 boy who received 8 of the 35 responses and 1 girl who received 7 of the 20 responses. These 2 students received teacher assistance and positive responses. The teacher provided responses to all of the boys, but did not respond to 3 of the 10 girls. In the postintervention observation, the teacher responded to all of the students and did not provide more attention to any specific individual.

The third-grade preintervention observation produced some strong evidence of teacher change in attitude in terms of gender equity. During the preintervention observation, the teacher only provided two responses in total to the girls. That teacher focused on one boy, in particular, providing six responses. The teacher provided no responses to seven girls and eight boys. After the intervention, the teacher provided responses to all of the students except for one girl. Furthermore, the teacher did not provide more attention to any specific individual. The writer concluded that the gender equity intervention was successful with the sample group as it met the objectives of the study.

Additionally, there was a pattern to the perceptions of the sample group to their own gender biases. The results showed that they were erroneous. The writer concluded that these teachers realized that they did possess some gender biases. The teachers explained that the intervention session activities had contributed to this revelation. During the second intervention sessions, the writer explained that there was a total ratio of 44 responses to girls and 110 responses boys. In response, the teachers offered several reasons behind this discrepancy. The third-grade teacher explained that there were more boys in that room. That teacher also explained the boys in the class were easily distracted, did not pay attention, and were less mature than the girls. Moreover, the third-grade teacher claimed that the boys spoke out more and questioned the teacher when they did not understand. The second-grade teacher added that the boys were often louder and did not follow instructions as well as the girls. Similarly, the first-grade teacher claimed that boys were less likely to follow the directions provided by their teacher and, thereby, needed the teacher's assistance while they were working.

The selected sample group of teachers discussed what they were presently achieving in their teaching activities that fostered gender equity and what more they could do to support gender equity in their own classrooms and in the computer laboratory. The teachers described procedures, such as setting up a rotating schedule for students to use the computer and using random selection processes of choosing names from a jar. Others claimed they do not use pink or blue to depict certain genders. However, one of the teachers admitted to often allowing the girls to be first and created lists of boys and girls for that teacher's personal records. Above all, the teachers believed that society plays a huge part in the development of role play.

In addition, the teachers expressed interest in expanding their education on both gender equity and technology issues. The teachers expressed interest in additional professional development sessions and learning opportunities as well as ongoing informal discussion between staff members and administrators.

However, the writer concluded that there were certain circumstances that could have affected the computer laboratory observation results. The behavior of the boys and girls could have factored into the results of the pretesting and posttesting observations. In both observation periods, the boys seemed more aggressive in their pursuit of help than the girls did. The writer witnessed boys waving their hands while the girls seemed content to figure out their problems on their own. Moreover, the teachers involved in the intervention agreed that the boys were more aggressive in many circumstances.

The findings suggest that there is a problem in relation to gender equity, education, and technology. Particularly, research has shown that the attitudes and behaviors of elementary school teachers regarding technology and gender equity correlate to the success of technology in the classroom. Thompson et al. (as cited in Tatar & Emmanuel, 2001) contended that gender is not considered significant to elementary school teacher training. The implications of this study showed that many of the teachers had not been aware of the problems gender inequality could cause. They had not experienced any gender equity training before the professional development sessions.

The male and female participants in the study exhibited certain gender-specific behaviors in the computer laboratory that correlate to the research available on the topic (AAUW Educational Foundation, 2000). The elementary school boys dominate computer use by crowding the girls out. The teachers in the study explained the same phenomenon happening in their classrooms. Boys were often more likely to help the teachers with technology in the classroom for a variety of reasons. Additionally, the teachers viewed the males as more aggressive and the girls as more passive regarding technology. Researchers (Gurian & Henley, 2001; Siann, MacLeod, Glissov & Durndell, 1990) agreed that the boys tend to seek out computers whereas the girls often step aside.

Moreover, this study revealed that gender equity should become systemic and should be built into teacher education programs as well as ongoing teacher professional development. Sanders (2002b) contended that this endeavor must be on the agenda of the teacher education profession as well as the college or university that is schooling the preservice teachers. The topic of gender equity should be built into education courses and curricula. Finally, the study supported the research that teacher educators need a concise program of instruction as well as materials to establish a reliable means of teaching gender equity.

These findings have further implications for the field of education. Data from this study implied that teachers who are exposed to gender equity training tend to exhibit more gender equitable behaviors than they did before the training. The data indicated that teachers provide more equitable assistance to their students after being presented with gender equity training.

Additionally, the writer advocated adopting a proactive stance in regard to gender equity education among faculty and staff members (Brusca & Canada, 1992). If schools choose to ignore, deny, or view the technological gender gap as a natural state of affairs, the gap will widen. The findings in this study indicated that schools should attempt to create an environment that provides for gender equitable technology opportunities for both the male and female students. Simply ignoring the problem will not make it go away. Brusca and Canada asserted that without intervention, the technological gender gap will only widen. Furthermore, the findings showed evidence that when educators assume a proactive stance toward ensuring gender-equitable computer opportunities, their attitudes and teaching behaviors change.

School leaders, such as principals and curriculum directors, should be aware of gender issues and matters. These concerns should be an integral part of teacher observations and evaluations. Additionally, curriculum developers and directors need to be concerned with gender issues when choosing and developing curriculum.

Limitations

This study had several limitations, delimitations, and constraints. First, the writer was limited in scope due to the sampling procedure (Gall et al., 1996). In this study, the writer used a convenience sample of elementary teachers in one school district. This specific sample was

located where the writer worked, and was not representative of the entire population. Because the study was confined to one small, suburban school district located in northern New Jersey, it was delimited to one elementary school in order to focus on the population of kindergarten through third-grade teachers.

The data collection method of using a questionnaire presented some limitations (Gall et al., 1996). First, some of the general group of teachers did not return the initial questionnaire. Some also did not return the concluding questionnaire. Moreover, some of the general group did not complete all of the questions in the questionnaire, thereby, threatening the validity of the study. Additionally, the writer trusted that the respondents were being honest and candid. Often, respondents try to respond with answers that they think the writer wants to hear.

Additionally, there were situational variables that limited the study outcomes. These conditions included variables, such as lighting, heating, and ventilation (Gall et al., 1996). These environmental variables possibly affected how the subjects responded to the interviews and the questionnaires. Moreover, the psychological and mental conditions of the subjects influenced the results of data collection.

Furthermore, the study was delimited in the scope of time required to complete the study. Although a longer time period could have facilitated a more accurate longitudinal study, the time range of the study was restricted to the school year. The selected sample of teachers was only available for this duration of time.

Recommendations

Based on the findings, conclusions, and implications of this study, the writer has several recommendations for future research and practice. First, additional research should be conducted to better understand the connection between elementary school students, teachers, gender, and technology. Research should be conducted using larger and more diverse populations. The writer suggests completing this study in both elementary and secondary school settings to see if the findings are complementary. Replication of this study with different samples and populations would confirm results that the intervention strategies lead to teacher awareness of gender issues.

Moreover, more studies regarding gender and technology should be conducted in different geographic areas. This study was conducted in a suburban school district in the northeastern area of the United States of America. It should be replicated or modified to be conducted in other areas of the country as well as in other nations. It would be interesting to see if gender issues were similar in other areas of the world. Do teachers in nations outside the United States of America place as much emphasis on gender?

The writer recommends further research regarding gender and technology using elementary school students as subjects. Although this study focused on technology in a computer laboratory, a potential study could examine gender, technology, and the classroom. Another one could look at gender, technology, and technology at home. It could investigate the connection between gender and home computer use.

The writer recommends that studies be conducted asking what teachers think the issues are surrounding gender and education. As Sanders (2005) explained, there is a glaring hole in the research on teachers and their point of view. The writer suggests further exploration into the field of gender equity education and preservice teacher training as well as continuing professional development for current teachers.

The writer also suggested asking gender equity activists to develop solutions for problems. Sanders (2005) asserted that the most "developmental work originates in the activist's belief in their ability to produce programs and materials that teachers will value and that will be effective in increasing female participation in technology" (p. 3). Activists may be able to assist educators and other individuals involved in technology education.

Additionally, curriculum developers should use the research results of this and other gender-based studies to design and develop curriculums that are less gender-biased. Particular attention should be placed on technology education, science education, and mathematics education curriculums. Lewis (1999) recommended further historical research aimed at telling the story of women in the field of technology.

Educators and administrators should devote effort and resources into developing less gender-biased instruction. This effort should include additional professional development opportunities for teachers and administrators. These opportunities should include professional development sessions designed for gender equity training. These sessions may include technology training or may simply be directed at common gender issues.

The writer also recommends structuring the physical and social environments of computer laboratories and classrooms to enhance gender equitable learning opportunities (Brusca & Canada, 1992). The physical structure of computing facilities, such as computer laboratories and classrooms, should be gender equitable. Brusca and Canada explained that many technological areas contain individual and segregated cells and conform to a masculine separation and individuation social style rather than to a feminine social style, which is characterized by personal connections and networks. The writer suggests adjusting computers and other pieces of technology in such a way that allows for more interaction among female students. Brusca and Canada suggested strategies, such as peer tutoring, team work, and computer networking, to connect people in order to reduce female interpretation of computers as isolating, nonsocial machines.

Additionally, the writer recommends more computer time for females. Because males tend to dominate computer laboratories and computer resources, providing females-only times in computer facilities and females-only computer classes could reduce gender bias in schools (Brusca & Canada, 1992).

Software developers should also use the results of gender-based studies to cultivate less gender-biased software programs. Inkpen (1997) alleged that many computer games are designed by men for the young male market. Moreover, gender biases are found in these games, which often involve violence and use women as objects to be rescued (Provenzo, as cited in Inkpen). Inkpen recommended that additional research be conducted on how to effectively design and use educational multimedia in a learning environment without gender bias.

Additionally, advertisers should consider gender when promoting technology products. They should aim to have an equal representation of men and women in advertisements. Although there are more females in advertisements at the time of this study, they contain images of women in novice or helpless roles. Moreover, women are portrayed in a passive manner, suggesting they have limited or no computer ability.

Above all, the profession should focus more closely on gender equity issues while developing educational resources. This concentration is particularly important for technology teachers and coordinators, many of whom have relatively little formal training in gender education. Continued professional development can assist in resolving this inadequacy.

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