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Instructional Computer Technology: Implications for Gender Achievement in Nigeria

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Abstract: This study examined the instructional computer technology with its implications for gender achievement in Nigeria. The setting was in Graphcom Independent Educational Computer Laboratory, Ilorin in Nigeria. The participants were randomly selected Junior Secondary School (JSS) III students in Ilorin West local government area of Kwara State for a holiday computer technology instruction. A total of 30 students (15 boys and 15 girls), aged 15 and 16 years old, participated in this study. Scores from a pretest and posttest of male and female students were compared using Paired Sample t-test with repeated measures and gender as the factor. Analysis of data showed that there were gender differences in computer technology achievement. The findings were statistically significant. The results confirmed earlier findings and added to knowledge about gender differences and achievement in computer technology.

Key words: Gender, computer technology, Junior Secondary School (JSS), knowledge, pretest, posttest

INTRODUCTION

Claims of gender inequities in education particularly in math, science and technology (AAUW, 2000, 1991, 1998), coupled with the growing trend of technology use, not only in education, but in the current and future workforce (AAUW, 1998; Robertson, 1998), indicate that females may need to be better prepared technologically, so as to compete with males in the new knowledge-based economy. A report by the American Association of University Woman (AAUW, 1998) concluded that, as technology is increasingly integrated into the education system, educators need to ensure that females gain ground and become more involved in technology fields in order for them to achieve economic independence in the industries of the 21st century.

However, according to some research, females are not gaining this crucial ground (AAUW, 1998, 2000; Huang *et al*., 1998; NCES, 2000; Neumann, 1991). Lichtman (1998) observed that the low number of woman who take computer science, who choose computer science as a field of study and who are employed in technology related fields confirms that computer science is far and away a male dominated world. Females make up only a small percentage of students in computer science and computer design courses (NCES, 2000). As well, females are less likely than males to say that they like and are good at technology and are less likely than males to exhibit computer confidence and have a positive attitude about computers (AAUW, 1998).

Computers are commonly identified with the areas of mathematics and science, areas in which for many years there has been a widespread concern about sex-related differences. It is not surprising, therefore, to find similar differences emerging in the area of computers. Much research and discussion have gone into investigating gender differences in students at all grade levels in learning and achievement in the areas of mathematics, science and technology. The research literature on computer education has examined gender differences since the early 1980s (Young, 2000). In the educational research literature, various factors associated with gender differences have been explored in connection to computer technology achievement.

In response to these gender equity issues in education, a small but growing number of advocates for single-gender education are emerging. Meg Milne-Moulton of the National Coalition of Girls Schools claims that there is resurgence in single-sex education that has been spurred by both popular opinion and hard research that girls are shortchanged in coeducational classrooms (Lehmann-Haupt, 1997). A single-gender classroom can lead to higher self-esteem in females (Gillibrand *et al*., 1999) and a single-gender setting may increase female participation, as well as females' interest in math and science (Streitmather, 1997; Warrington and Younger, 2001). Other research indicates that females perform better than male and feel better about themselves in a single-gender environment (Gillibrand *et al*., 1999; NCGS, 2000; Streitmatter, 1997, 1998; Warrington and Younger, 2001).

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Some findings indicate that females are at a disadvantage in a mixed-gender school particularly when learning computer technology (AAUW, 1998, 2000; NCES, 2000; Nicholson *et al*., 1998).

Research on gender differences in behavior toward computers has increased in the past 20 years. Numerous articles have been written focusing on differences regarding computer aptitude and actual computer use. The AAUW (2000) Report, Tech Savvy: Educating girls in the new computer age, notes that all future jobs including those in the arts, medicine, law, design, literature and the helping professions will involve technology. Because of this emphasis on technology in the workforce, females may, in many cases, need to be as competent as their male peers in using technology. Although, at present, it is unknown whether a single-gender education will promote this competency, it is viewed by some as an alternative to the marginalization and domination of females in mixed-gender classrooms (Gillibrand *et al*., 1999).

Gender differences in response to computers have been widely reported by various experts in the educational field. Computers are not inherently biased. However, the way computers are used can often reinforce gender bias. Parents and teachers should be sensitive to cultural biases and strive to expose both sexes to the advantages of computer technology. New ideas should be devised in order to promote greater equity in computer use and help close the technological gap between boys and girls (Dorman, 1998).

Educators need to link the curriculum and technology with student interests. Both male and female students use computer applications that can be linked to the educational setting, such as word processing, accessing information and completing homework, reports and projects. But students also use computers for communication, self-expression and personal interest (Houtz, 2001). How females relate to technology and the value they bring to technology are often ignored or devalued in education. Once educators begin to understand how girls lose interest in technology and recognize the different learning styles of each gender, strides can be made in supporting girls and women in choosing computer-related careers and using computers as a medium of expression.

Previous research has consistently documented gender differences in computer achievement. From these findings, one would expect to see males with higher achievement levels than females. The purpose of this study was to determine if gender differences exist in computer achievement based on the results from repeated testing measures. This study therefore investigated gender differences in computer technology achievement.

MATERIALS AND METHODS

Experiment one

Participants: The study was conducted at Graphcom Computer Centre, a private computer institute located in Ilorin, Kwara State in Nigeria. Data collection took place in the spring of 2005 students' holidays. The research incorporated an experimental data collection technique and built on data collected from the previous phases. The instrument, which was researcher designed and validated focused on the present educational experiences of students' learning technology. The learners in their pairs, were invited to compare these experiences with those of their past computer learning. Random sampling method was used to select JSS III students that were exposed to computer technology instruction during their terminal holiday. The ethnicity information for population of students in JSS III class in Ilorin metropolis in Kwara State of Nigeria shows that students were mostly 92% Yoruba speaking and 15% Ibo and 2% Hausa speaking students from low and middle class parental backgrounds. A total of 30 students (15 boys and 15 girls), aged 15 and 16 years old, participated in this study. Students were matched based on reading scores from the first term examination result from their schools and placed into same sex pairs.

Measurement instrument: A pretest was given to investigate possible differences between males and females in terms of computer technology achievement. The pretest consisted of validated researcher designed 10 multiple-choice questions. Students were given the same 10-question multiple-choice pretest as a posttest measure.

Procedures: The researcher has taught educational technology undergraduate students since 1996 and also has an in-dept capability of delivering computer technology training to the Junior Secondary School (JSS) and Senior Secondary School (SSS) students. According to the curriculum guide for technology education developed for Junior Secondary schools, with focus on the National policy on education, the purpose of the JSS Arts/technology program is to provide students with an orientation and exploration into the technologies of communication, manufacturing and construction and energy and power control. A further purpose is to augment the students' base of concrete experiences providing better foundation for the development and understanding of more abstract academic concepts. In the Graphcom independent educational computer laboratory, students worked independently through 3 technology units. Pairs of students completed 8 self-directed activities from the computer laboratory without teacher instruction. All the units began with a brief history of the subject

followed by 8 days of step by step instruction and was concluded with a problem solving activity. Each area included a pretest and posttest. Students completed a set of study questions and vocabulary words while progressing through the unit. In addition, all units included multiple worksheets, experiments, demonstrations and problem solving activities. At the beginning of second term holiday, same sex students were randomly paired in 4 explorations of technology classes. Students were given a pretest on graphics design and assigned to work using CorelDraw 10 graphics package. Over a period of 2 weeks, students spent 40 min a day working on the directed activities found in the CorelDraw graphic tools. In the computer graphics lessons students learned about the history of graphics and gained a working knowledge of how to manipulate a computer graphics package. Students generated numerous graphic designs by utilizing existing CorelDraw 10.0 software. CorelDraw-Version 10.0. CorelDraw is an interactive computer based graphics tool developed by Corel Corporation, an internationally recognized developer of award-winning business productivity, graphics and operating system solutions on the Windows, Linux, UNIX, Macintosh and Java platforms. Corel also develops market-leading, Web-based solutions including applications, e-commerce and online services. For access to these services and more information about Corel and its products, see www.corel.com or www.corelcity.com on the Internet. Corel is headquartered in Ottawa, Canada.

Study design and data analysis: This was a casual-comparative research study. This design involved selecting 2 groups differing on an independent variable (gender) and comparing the groups on a dependent variable (achievement). The scores from the pretest and posttest of male and female students were compared using Paired Sample t-test with repeated measures and gender as the factor. The repeated measure was the pretest and posttest. The probability level was set at alpha = 0.05 significance level.

Experiment two

Procedures: The participants were the same as in Experiment 1. The measurement instrument was provided by the same source sited in the Experiment 1. The researcher followed the same procedures outlined in Experiment 1. Experiment 2 replicated Experiment 1 with a different content module. At the beginning of third term holiday break, same sex students were paired in 4 Computer Technology classes. Students were given a pretest on television broadcasting and assigned to work in the television production module area. Over a period of 8 days, students spent 40 min a day working on the student directed activities based on the researcher designed activities as assembled from television broadcasting manual by Graphcom Independent Educational Computer Laboratory. Students in television broadcasting learned the basic principles of television broadcast production. Students learned how to write scripts, produce and record news broadcast. Hands-on activities provided students with the opportunity to learn how to operate a camcorder, research news stories and develop a script. Students worked in pairs to complete the activities and were instructed to solve problems within their group. All classes had the same assignments. Academic objectives were the same for each class. All tests measuring achievement were also identical.

Data analysis Data analyses used was the same procedures as outlined in experiment 1. At the completion of this study, results of the pretest and posttest were compared using Analysis of Covariance with repeated measures and gender as the factor. The repeated measure was the pretest and posttest. The probability level was set at = 0.05 for a two-tailed test.

RESULTS

Experiment one: The results of experiment 1 (using the Graphics module) indicated that there were gender differences in the graphics pretest scores and posttest scores. Although the female pairs had higher pretest scores (M = 68, SD = 7.79) than the males (M = 54, SD = 5.19), after completing the unit of instruction, the males had a much higher posttest score (M = 75, SD = 8.07) than the females (M = 55, SD = 5.19 in Graphics design knowledge and skills for the girls.

When pretest scores (existing differences among the individuals) were partially led out from posttest scores, the girls scored significantly higher (made significantly more improvement) than the boys did (Table 1). When the students computer graphics production scores were compared upon posttest, boys scored significantly higher (Table 2).

Experiment two: The results in this study indicated again that there were gender differences in the television broadcasting pretest scores with female and female group mean of 60 and 66, respectively and posttest scores, female and male group mean were 70 and 54, respectively (Table 3 and 4). However, using the broadcasting module of study, the girls improved more than the boys. When posttest scores were partially led out from pretest scores, girls scored significantly higher (Table 4).

Table 1A: t-test statistics on the result of male and female in computer graphics pretest

Gender	N	Mean±SD	SEM
Male	15	54.80±5.19	1.34
Female	15	68.00±7.79	2.01

Table 1B: t-test statistics on the result of male and female in computer graphics posttest (Paired samples test)

	Paired differences							
				95% confidence interval of the difference				
Pair	Mean	SD	SEM	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 Boy-Girl	-13.2000	8.7521	2.2598	-18.0468	-8.3532	-5.841	14	0.000

Table 2A: t-test statistics on the result of male and female in computer graphics posttest

Gender	N	Mean±SD	SEM
Male	15	75.06±8.07	2.08
Female	15	68.00±5.20	1.34

Table 2B: t-test statistics on the result of male and female in computer graphics posttest (Paired samples test)

	Paired differences							
				95% confidence interval of the difference				
Pair	Mean	SD	SEM	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 Boy-Girl	-20.2667	8.5846	2.2114	-25.0096	-15.5237	-9.165	14	0.000

Table 3: t-test statistics on the result of male and female in digital television production pretest

Gender	N	Mean±SD	SEM
Male	15	66.53±4.96	1.2831
Female	15	60.27±6.62	1.7084

Table 4: t-test statistics on the result of male and female in digital television production posttest

Gender	N	Mean±SD	SEM
Male	15	54.33±4.96	1.2824
Female	15	70.20±8.84	2.2849

DISCUSSION

The results of the current study support earlier findings that show gender differences in computer technology achievement. However, these differences may depend on the unit of study. In the current study, boys improved more in the graphics design module while the girls improved more in the broadcasting module. Thus only the graphics design module of study replicated the earlier findings that males have higher achievement levels than females in computer technology. It would be interesting to know if the graphics topic was more appealing to middle school boys than to girls of the same age and if the reverse were true for the broadcasting module. Perhaps motivation made a difference. Or perhaps the graphics module had a more traditional academic format, for example, in the study of the history of graphics.

The results confirm the earlier findings that there are gender differences in technology achievement. But JSS students of today may be different from those used in earlier studies, in this experiment the boys did better on graphics design and the girls did better on broadcasting. In some earlier studies that confirmed gender differences, the AAUW (1998) study on single-gender education involved an extensive review of the research conducted on single-gender education. Although that study concluded that there was no evidence that single-gender education was better than mixed-gender, it did find that, in most cases, females confidence and risk-taking increased in single-gender settings. This finding is congruent with the perceptions of participants in this study of increased confidence in the single-gender setting as compared to the mixed-gender setting.

In addition to findings related to confidence specifically in technology settings, the findings of this study are also congruent with those of research on female confidence in single-gender environments in general. Previous research conducted by Gillibrand *et al.* (1999), Streitmatter (1997) and Warrington and Younger (2000) identified differences in confidence and participation levels of females in mixed-and single-gender environments. One of the main findings of Gillibrand *et al.* (1999) was that females in the single-gender learning

setting had increased confidence and participation levels. As well, females in this study were found to be more willing to participate in discussions, seek help when it was needed and share ideas in the single-gender setting.

Similarly, Streitmatters (1997) study found that girls in single-gender high school Algebra classes as compared to mixed-gender algebra classes, were more likely to ask questions and more likely to answer questions on the subject matter. A similar study by Warrington and Younger (2001) found females frequently expressed having more confidence in themselves in the single-gender setting. As well this research found that girls found it easier to contribute to oral discussions and to ask questions without being ridiculed in the single-gender setting. Finally, girls expressed caring more about their work and feeling less inhibited in their single-gender classroom.

Obielodan (1991) further explained that as the children develop biologically, the girls draw to show details on their physical development while boys engage in cartoons and satirical drawing of teachers, parents and classmates who hold enviable positions. Girls at times, due to their patience, perform better than boys in theories because boys must have been overwhelmed by their adolescent stage. It was observed that only about half of the items were answered correctly in secondary schools with girls scoring better than boys. Although literature sources confirmed the fact that girls generally favoured when considering sex differences in drawing of the human figure (Onasanya, 2002a), it was considered slightly different when 3-Dimensional modeling was considered. Brown (1971) reported that three, four and six years-old girls were more advanced in modeling the human figure than their male counterparts, while the results of five years-old children did not uniformly favour one sex. However, Onasanya (2002b) did not record any superiority of girls for the 3-D human figure representation, either in the total sample, within groups, or within the experimental group following instruction. Thus, in Onasanyas (2002a and b) study, girls performed equally well with boys. There was no difference in their performance. These previous studies further establish gender differences in 3-D animation performance. This study adds to our knowledge about the achievement of both boys and girls.

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