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THE USE OF COMPUTERS IN LEARNING MATHEMATICS: A CASE STUDY OF SELECTED JUNIOR SECONDARY SCHOOL STUDENTS' GENDER ATTITUDES IN KADUNA NIGERIA.

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ABSTRACT
This research work was based on the analysis of students' gender attitudes on the use of computers in learning mathematics in junior secondary schools from Kaduna North and South Local Government Areas in Nigeria. Attitudinal variables considered were usefulness, excitement, and anxiety of students while using computers in learning mathematics. Data were collected using structured interviews with closed and open-ended questions, and analyzed by qualitative and quantitative techniques. School and classroom observations were done using structured schedules. Cognitive constructivism as developed by Piaget form the theoretical frame work for this research. The findings of the study showed that gender differences exists in the three variables which are usefulness: boys (52%) and girls (61%), excitement: boys (38%) and girls (42%) and anxiety: boys (34%) and girls (50%) while using computer to learn mathematics. It was concluded that the nature of computer studies curricula and teaching methodologies used in learning mathematics contributed significantly to these gender differences.

Key words: Computers, Learning Mathematics, Junior Secondary, Students Gender, Attitudes**.**

Introduction

The introduction of Information and Communication Technology (ICT) into the school curricula raised some hopes that it could be one of the means of communication in classroom instruction where gender differences could be minimized. Earlier, when ICT was introduced in schools, it was perceived as a male domain and boys were considered people with technological know- how, where girls were guests and boys hosts (Elkjaer, 1992 in Jones and Smart, 1993). The interactive nature of ICT materials was believed to provide the opportunity for students to analyze the process, assimilate and work independently while learning mathematics. Such an opportunity was also believed to be

useful to especially girls where some classroom practices were found to create an undesirable learning environment for girls (Kaino and Mazibuko, 2001). Calculators and computers are instruments where students could interact independently in classroom instruction. Compared to traditional classroom learning, it was assumed, calculators, computers and other forms of ICTs could offer neutral environments for both sexes during learning.

Earlier studies on the use of ICT in mathematics instruction did not consider a computer to be a neutral value and attitudes towards information technology were expected to be even more extreme than those towards other educational media (Anderson, 1985). If gender-related differences in attitudes toward the computer use in learning mathematics had to follow similar patterns to those established for science or other subject domain, as girls most often tended to associate computers with mathematics and technology (Levine, 2006),then there would be little hope for improved attitudes toward learning among girls when computers are integrated into mathematics instruction. Some studies had already indicated that boys 'attitudes towards computers were generally more positive than those of girls (Clariana &Schultz, 1993; Levine & Gordon, 1989; Sutton 1991). Also other studies had indicated that boys and girls differed in their perception of the role of computers in learning especially mathematics, and in their preference for different types of computer-based activities (Hall & Cooper, 1991; Sanders,1984). According to (Olumuyiwa, Akinsola, Suleiman & Ademuwagun, 2020) application of computer technology in delivering mathematics instructions had significant effects on students' attitudes towards the subject.

Research Questions

The study was designed to answer the following research questions:

(i) What were the students' perception on the usefulness of computers in learning mathematics?
(ii) How excited were the students while using computers to learn mathematics?
(iii) How comfortable are the students learning mathematics with computers?
(iv) How confused are the students learning mathematics with computers?

Conceptual Framework

The study considered only three variables, i.e. usefulness, excitement and anxiety in learning mathematics using computers in classroom to be among determinants of students' gender attitudes towards learning this subject. One approach of learning involving the cognitive constructivist theory of learning was considered. Cognitive constructivism as developed by Piaget (1953 &1955) asserted that learners created their own knowledge through personal experiences. It was argued that personal experiences

enabled learners to create mental images in their minds. Piaget argued that thought arose out of actions the learner performed with objects and not from the objects themselves. This argument put up the premise that thought arises after appreciation of the significance of operations done by the learner himself/herself with materials and not from the performance of the materials themselves. Piaget maintained that action was the basis of thought and that the type of concept that developed depended essentially on the level of abstraction or dissociation of which the learner was capable, depending on the quality of the sequences of action in the mind the learner could elaborate. Some studies have also indicated that learning was constructed through mental and physical activities (Adeyinka & Mayor,2005; Epstein 2002) whereby the learner got direct sense impressions like touching, seeing and/or smelling. In such a process, learners were able to discover knowledge themselves.

Piaget's constructivist approach has attracted a number of debates among educators with interest. The approach to involve active construction of knowledge by the learner and not passively received from the teacher, was received by many educators and researchers as a pragmatic strategy in learning. This approach has promoted a shift from the teacher centeredness approach of teaching to learner-centeredness approach, which is regarded as a new concept of teaching. The concept of learner-centeredness has evolved as a contemporary counter to the traditional teacher-centered approach that has been considered authoritative in nature (Pulist, 2005). The learner-centered approach is said to empower learners to take control of their learning as also they controlled their destiny (Muller, 1997). Furthermore, learners were provided with greater autonomy and control over the choice of subject matter, learning methods and pace of study (Gibbs, 1992). Such an approach is against the notion of giving or transmitting a predetermined body of knowledge to the learner who was believed treated as an object in a traditional approach. Learner-centeredness encouraged individual discovery where learners evolved their own truths or understanding (Walker and Daets,2000). In this learning process, the learner was given the opportunity to process information, solve problems and make decisions at his/her own (Blumenfeld et al, 1991). Through learner centeredness, learners were believed to build confidence, create an anxiety-free atmosphere for learning (Pulist, 2005).

This study was thus embedded in Piaget's constructivist theory of learning where learners were believed to acquire knowledge independently and create their own knowledge when they learnt mathematics using computers. The interactive nature of using computers was believed to provide the opportunity for learners to work independently. In particular, the opportunity for female learners to work independently was thought to be useful in coeducation schools where the classroom environment had been described to contain undesirable climate for females to learn appropriately (Kaino,

1997; Anstey 1997; Jungwirth 1997). The premise put forward by this study was whether the use of computers in mathematics instruction delivery could minimize the gender gap in learning this subject. This premise was made with knowledge of the existence of classroom gender practices among students of both gender as well as from teachers during instruction as reported in various earlier studies (Kaino and Mazibuko, 2001; Kaino, 1997; Cheng, 1993; Fraser,1986; and others).

METHODOLOGY

The Study Area

Kaduna north and Kaduna South local government areas were selected purposively for this research out of the 23 obtainable in the state because they serve as the nerve center of the state in terms of population and educational institutions distribution.

Sampling Techniques and Sample Size

The study employed purposive sampling technique for the selection of students from one junior secondary (Jss1) school each from the two Local Government Areas. The total sample comprises of 72 respondents randomly selected from each class stream.

Method of Data Collection

This study employed both qualitative and quantitative research techniques. Structured interviews with closed and open-ended questions were used to elicit information from students and teachers. Classroom observations were done using structured schedules. Pre-test and validation were done before main data collection.

Method of Data Analysis

The quantitative data involving closed-ended questions was analyzed using the Statistical Package for Social Sciences (SPSS). Responses were analyzed using a 4-point Likert scale, frequencies and pie charts. The Likert scale had the following ratings: Very useful (4), Useful (3), Averagely useful (2) and Not useful (1); Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). Total score of responses were computed and average scores determined. The average values indicated levels of usefulness and agreement; and significances were tested at 0.01 and 0.05 levels of significant.

From the qualitative data, involving open-ended responses, individual responses were recorded and similar views grouped together, presented in frequencies and then transformed into percentages. The t-test was used to determine differences that existed between boys' and girls' responses. The t-test analysis was also done on a combined sample between two genders to detect any differences.

Results

Table 1: Students' perception on computer usefulness in learning mathematics by gender

	Ratings	No of Boys	No of Girls
	Very useful	**17(51.5%)**	**22(61.1%)**
	Useful	**14(42.4%)**	**14(38.9%)**
	Averagely useful	**2(6.1%)**	**0(0%)**
	Not useful	**0(0%)**	**0(0%)**
	Total	**33**	**36**
Missing Data		**3**	
	G/Total	**36**	**36**

Averages on Likert scale: Boys-3.46, Girls-3.61, and Boys & Girls-3.54. T-test: not significant at 0.05 (0.650 0.05)

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From Table 1 above the result on the usefulness of using computers in learning mathematics shows that more girls (about 61%) than boys (about 52%) said computers were very useful. Similarly about 42% of boys and 39% of girls said computers were useful. Furthermore 6% of the boys said using computers in learning mathematics were averagely useful. Likert scale averages (boys-3.46 and girls-3.6) also indicated that students of both gender considered computers to be useful in learning mathematics though girls' average was higher than those of boys. While more girls than boys indicated that computers were useful, the differences were not significant at 0.05.

Table 2: Students' excitement of using computers in learning mathematics

Are you excited using a computer in mathematics class?

	Ratings	No of Boys	No of Girls
	Very much	**13(38.2%)**	**15(41.7%)**
	Much	**16(47.1%)**	**15(41.7%)**
	Averagely	**5(14.7%)**	**2(5.6%)**
	Not a tall	**0(0%)**	**4(11.1%)**
	Total	**34**	**36**
Missing Data		**2**	
	G/Total	**36**	**36**

Average on Likert scale: Boys-2.94, Girls-3.12.T-test: not significant at 0.05 (0.77 0.05)

Field Study 2022

Table 2 above indicated the level of excitement students showed in learning mathematics using computers. The 4-point Likert scale was used and responses were recorded in frequencies and then computed into percentages. Most students indicated that they were excited using computers in learning mathematics. About 42% of girls and 38% of boys indicated very much excitement of using computers in learning mathematics. On the average, many students of both genders enjoyed learning mathematics with computers and girls had a higher average score on the Likert scale than boys. From the table about 11% of the girls (compared to 0% of boys) were not excited at all using computers in learning mathematics. The analysis further showed no significant differences of excitement among genders at 0.05levels. Some reasons were sought from girls who said they were not excited at all learning mathematics using computers. The reasons were given as " I hate using computer in mathematics classes , "I do not know much about computers , and "The teacher is the one who does almost everything.

Table 3: Students' comfort when using computers in learning

Do you feel uncomfortable in learning mathematics with computer?

	Ratings	No of Boys	No of Girls
	Very much	**0(0%)**	**0(0%)**
	Much	0(0%)	3(8.3%)
	Somehow	8(24.2%)	15(41.7%)
	Not at all	25(75.8%)	18(50%)
	Total	33	36
Missing Data		**3**	
	G/Total	**36**	**36**

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Result from Table 3 above shows that many boys were comfortable with the use of computers in learning mathematics (about 76%) than girls (50%). Three girls who said they were "much" uncomfortable gave the reasons as "Because I haven't learnt much about computers" (1), "Sometimes I don't know what to press" (1) and "The teacher is fast " (1).

Table 4: Students' feelings when using computers

Do you feel confused when using a computer in learning mathematics?

Ratings	No of Boys	No of Girls
Very much	**3(8.3%)**	**2(5.6%)**
Much	**4(11.1%**	**3(8.3%)**

Somehow	**7(19.4%)**	**19(52.8%)**
Not at all	**22(61.1%)**	**12(33.3%)**
Total	**36**	**36**

t- test 1.00(>0.05)

Field Study 2022

Result from Table 4 shows that more boys (about 61%) than girls (about 33%) were not worried when using computers in learning mathematics. Girls' worries were seen in their ratings that constituted about 67%. A sample of girls who indicated much worries said, "learning mathematics with computers was difficult (3)", "there were many buttons and instructions to follow (1)" and "I am dealing with something am not sure of (1)". The reasons for boys who also indicated much worries were "little knowledge in computer application in mathematics (5)", "many instructions (1)" and "feeling that am not doing something right (1)

Discussion

The general view by many students that they found learning mathematics using computers to be useful was a positive sign towards the use of technology in delivery. However, more girls than boys found computers to be more useful in learning mathematics. Gender differences on usefulness of computers in learning mathematics were noted among students where many 100% of the girls compared to 94% boys opined that computer was very useful, useful and averagely useful in learning mathematics. Students' views that computers were useful could be considered as an appreciation to the use of technology in mathematics instruction. An earlier study in a number of schools by (Kaino and Salani, 2004) showed that students did not consider the use of calculators to be useful in learning. Such a finding would be regarded as a setback at the time when traditional ways of instruction were to be innovated and improved to cope with current developments in technology. Students' perceptions on usefulness have been linked to participation in the subject studied.

For example in mathematics, students' perceptions on usefulness were associated with activities and tasks performed in class (Meyer and Koehler, 1990). And an earlier study by Fennema and Sherman (1977 & 1978) showed the existence of gender differences in perceptions on the usefulness of mathematics. The study by The World Bank (2006) in Ghana, Mauritania, Senegal, and Uganda found that when girls had access to computers, they would use them more often for academic research and communication with friends and family, increasing their reasoning and communication skills. They also used Internet access to obtain information on issues such as reproduction and sexuality, information not available from their families or communities.

Boys tended to use the computers for sports and music and received little academic benefit. It was also reported that when girls did have equal access to computers, their self-confidence improved. The finding by this study on the usefulness of computers in learning mathematics differed by gender tends to exhibit a gender pattern found in other studies.

Alternatively, it could be argued that excitement depended on the nature of the syllabi used by students at the time of conducting research. Excitement in learning has been associated with the value students attributed to the subject studied. The study by Kulm (1990) indicated that students enjoyed subjects they valued. Value was associated with the subject that students performed well (Wigfield and Meece, 1998). It was beyond the scope of this study to establish whether value attributed to using computers in delivery mathematics instruction contributed to gender differences in excitement. Also the finding that girls had more anxiety in learning than boys concurred with some other researchers elsewhere. An earlier study shows that secondary schools girls had more anxiety than boys in using calculators (Kaino & Salani, 2004) is one of such cases. Studies have also established a correlation that students who had more anxiety in learning had less excitement of the subject studied (Muthelo, 2003). Anxiety in learning has been described to affect confidence among learners (Wigfield and Meece, 1988; Richardson and Suinn, 1972). Confidence was described as one of important affective factors in learning (Reyes, 1984). According to (Olumuyiwa, etal 2020) application of computer technology in delivering mathematical instructions had significant effects on students' attitudes towards the subject. The result of this study that girls had more anxiety than boys was an indication that could lead to less excitement, less confidence and less interest in learning mathematics using computers.

Conclusion and Recommendation

The finding that views on usefulness of computers in learning mathematics differed by gender was consistent with other studies elsewhere on gender disparities. However, the boys' were more excited in learning mathematics using computers with less or no anxiety than girls was also consistent with findings by other researchers. Anxiety found by this study among girls was related to less excitement (than boys) that could lead to less confidence and interest in learning mathematics using computers. Though gender differences existed in usefulness, excitement and anxiety, there were indications that students had the opportunity to work independently, discover and create knowledge. It was also realized from the findings that provision of equal facility to both gender in the same classroom environment could not necessarily mean equal access opportunities to learning. While the findings of this study could not be generalized to reflect gender attitudes in all schools, it was felt that attention should be drawn to the following for

further study: (i) the nature of computer studies curriculum adopted in teaching particular mathematical content areas where learners could identify as useful, (ii) exploration of areas (in mathematics) that could motivate students (especially girls) to enjoy learning mathematics using computers, (iii) teaching mathematics using computers that involved particular activities and exercises (from identified content areas) that could motivate girls to feel comfortable in learning and enjoy mathematics lessons without anxiety and (iv) exploration of girls' learning styles, attitudes, and behaviors in class.

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