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Technology in Learning: Narrowing the Gender Gap?

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The introduction of Information and Communication Technology (ICT) into the school curricula raised some hopes that it could minimize gender differences in learning. The interactive nature of ICT materials was believed to provide a favorable environment especially for girls to learn. This article reports the findings of the study that analyzed students' gender differences in learning using computers in Botswana junior secondary schools in the year 2006. Variables considered were usefulness and enjoyment of using computers in learning, anxiety in learning when using computers and interaction among students of both sexes. Data were collected using structured interviews with closed and open-ended questions, and analyzed using qualitative and quantitative techniques. The findings of the study indicated that while gender differences existed in anxiety and usefulness variables, some positive aspects in learning were visible when computers were used. At the end, suggestions on the way forward are outlined.

Keywords: Classroom Instruction, Computer Curriculum, Gender Gap, ICT.

INTRODUCTION

When ICT was introduced in schools many years ago, it was perceived as a male domain facility 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. 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 in learning process. Earlier studies on the use of ICT in instruction did not consider a computer to be a neutral value, and attitudes towards information technology were claimed to be even more extreme than those towards other educational media (Anderson, 1985). If gender-related differences in attitudes toward the computer had to follow similar patterns to those established for science or math, as girls tended to associate computers with math and technology (Levine, 2006), then there would be little hope for improved attitudes toward learning among girls when computers are integrated in 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, and in their preference for different types of computer-based activities (Hall & Cooper, 1991; Sanders 1984).

Studies on students' perceptions on usefulness have been linked to participation in the subject studied. In mathematics for example, students' perceptions on usefulness were associated with activities and tasks performed in class (Meyer and Koehler, 1990). Students' perceptions on the usefulness of computers are associated with student enjoyment in using computers. Enjoyment in learning has been associated with the

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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 computer studies contributed to gender differences in enjoyment. Student usefulness and enjoyment of using computers is also associated with student anxiety when using computers. Computer anxiety has been found to differ according to age groups where for example female university undergraduates were found to be more anxious than male undergraduates (Chua, Chen & Wong 1999). An earlier study in Botswana secondary schools (grades 17 to 18) that girls had more anxiety than boys in using calculators (Kaino & Salani, 2004) is one of such related cases in the use of technology. Studies have established a correlation that students who had more anxiety in learning had less enjoyment 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).

Conceptual Framework

This study considered four variables, i.e. usefulness in using computers in learning, enjoyment in using computers, anxiety in learning using computers and interaction among students of both sexes in learning using computers. Two approaches of learning involving the constructivist theory of learning were considered. These were the cognitive and social constructivist theories of learning. Cognitive constructivism as developed by Piaget (1953 &1955) asserts that learners create their own knowledge through personal experiences that enabled them to create mental images in their minds. This argument has a premise that thought arises through appreciation of the significance of operations done by the learner himself/herself with materials and not from the performance of the materials themselves. 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.

The use of computers in this study put across the premise that knowledge could be actively constructed by the thinking of the learner and not passively received from the teacher. It also put across the notion of learner-centeredness where learners were believed to build confidence, create an anxiety-free atmosphere for learning (Pulist, 2005). The learner-centered approach was said to empower learners to take control of their learning as also they control their destiny (Muller, 1997). Furthermore, through this approach learners were provided with greater autonomy and control over the choice of subject matter, learning methods and pace of study (Gibbs, 1992). Learner-centeredness was also said to encourage individual discovery where learners evolved their own truths or understanding (Walker and Daets, 2000). In this learning process, the learners were given the opportunity to process information, solve problems and make their own decisions (Blumenfeld et al, 1991).

On the other side, social constructivism was based on specific assumptions about reality, knowledge and learning. Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (Derry, 1999; McMahon, 1997). Social constructivists believe that reality was constructed through human activity and that members of a society together invent the properties of the world (Kukla, 2000). For the social constructivist, reality cannot be discovered: it does not exist prior to its social invention. Also to social constructivists, knowledge was a human product, and was socially and culturally constructed (Ernest, 1999; Gredler, 1997; Prat & Floden, 1994). They argue that individuals created meaning through their interactions with each other and with the environment they lived in. Social constructivists view learning as a social process that did not take place only within an individual or as a passive development of behaviors that were shaped by external forces (McMahon, 1997). It is argued that meaningful learning occurred when individuals were engaged in social activities. The use of computers in this study also had a supposition that interaction and cooperation among students of both sexes in computer classes could have a social influence on their learning process.

This study was therefore embedded in the two construct theories of learning where learners were believed to acquire knowledge not only through working independently, to discover and create their own knowledge but also through interaction with colleagues in class and cooperation among themselves in computer classes. The interactive nature of using computers tends to provide the opportunity for learners to work independently as well as in cooperate atmosphere. In particular, the opportunity for female learners to work independently as individuals as well as in groups was considered to be useful in coeducation schools where the classroom environment was described to contain undesirable climate for females to learn conducively (Kaino, 1997; Anstey 1997; Jungwirth 1997). The premise put forward by this study was whether the use of computers in instruction and the interaction of students with computers, and between students themselves could minimize the gender gap in learning.

This premise was made with knowledge of the existence of classroom gender practices among students of both sexes as well as from teachers during instruction as reported in various studies elsewhere (Kaino and Mazibuko, 2001; Kaino, 1997).

Aim of the study

The study aimed at analyzing students' gender differences in learning using Information and Communication Technology (ICT). Specifically, the study analyzed gender differences in learning using computers at form two secondary school level. The study was guided by the following research questions: (i) what were the views of students on the usefulness of computers in learning by gender? (ii) did students enjoy the use of computers in learning? (iii) did students get anxiety in learning when using computers? and (iv) what was the nature of interaction and cooperation among students of both sexes in computers lessons?

METHODOLOGY

The study employed both qualitative and quantitative techniques. Structured interviews with closed and open-ended questions were used to get information from students. Form two students (of ages between 12 and 15 years of age) were selected to represent the sample at junior level. The sample comprised 72 students from 10 junior schools (36 girls and 36 boys) selected at random from each class stream. Ten schools were selected from 9 districts in the country (one school from each district) and one school from Gaborone city. Pre-test and validation were done before main data collection. 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 and frequencies. The Likert scale had the following weightings: Very useful (4), Useful (3), Averagely useful (2) and Not useful (1); Strongly agree (4), Agree (3), Disagree (2) and Strongly disagree (1) and Very Much (4), Much (3), Somehow and Not at all (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. From the qualitative data, involving open-ended responses, individual responses were recorded. The number of similar views were noted and presented in frequencies and then transformed into percentages. The t-test method was used to determine any differences that existed between boys' and girls' responses. The t-test analysis was also done on a combined sample between two sexes to detect any differences.

FINDINGS AND ANALYSIS

Students were asked to state on the usefulness of using computers in learning by indicating the four levels of usefulness. The majority of participants (94%: 31/33 males; 100%:36/36 females) said computers were very useful. Likert scale averages (boys-3.46 and girls-3.6) also indicated that students of both sexes considered computers to be useful in learning 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 levels.

Students' reasons why computers were useful

Students who indicated that using computers in learning was useful were asked to state their reasons why they agreed. The views, which were open-ended, were analyzed and categorized into six types for boys and into seven for girls as shown in Table 1 below.

Many boys (about 36%) said computers were useful in searching for jobs while about 31% of girls said were useful for internet access. About 28% of girls also said computers were useful in searching for jobs. The t-test on similar views did not show any significance difference between boys and girls at 0.05 ($0.50<0.59$). Dominant views from both girls and boys indicated that computers were useful in search for jobs, Internet, access to information and knowledge.

Students' enjoyment of using computers in learning

Students were asked to indicate the level of enjoyment in learning when using computers. The 4-point Likert scale was used and responses were recorded in frequencies and then computed into percentages. Most students (86%:29/34 males, 84%:30/36 females) indicated that they enjoyed using computers in learning. On the average, many students of both sexes enjoyed computers and the analysis showed no significant differences of enjoyment among sexes at 0.05 levels. Some reasons were sought from girls who said did not at all enjoy learning using computers. The reasons were given as " I hate computer classes (2), "I do not know much about computers (1), and "The teacher is the one who does almost everything (1).

Students' anxiety in using computers

To determine student anxiety in using computers, students were asked to state whether they were comfortable and when they encountered the state of 'confusion" when using computers.

Table 1. Students' reasons why computers were useful

Boys		Girls	
Reasons	**Percentage/number**	**Reasons**	**Percentage/number**
Helpful in job search	30.6% (11)	Provide access to Internet	27.8% (10)
Provide accurate information	16.7% (6)	Helpful in job search	25% (9)
Fast in communication	13.9% (5)	Using computers is added knowledge	16.7%(6)
Helpful in doing assignments and research	8.3% (3)	Provide accurate information	5.6%(2)
Using computers is added knowledge	8.3% (3)	Fast in communication	5.6%(2)
Provide access to Internet	8.3% (3)	Useful for typing and printing pictures	5.6%(2)
No response	13.9%(5)	Provide accurate answers	2.8%(1)
		No response	11.1% (4)

Table 2. Boys' and Girls' reasons why they felt girls preferred to work alone

Boys		Girls	
Reasons	**Percentage/number**	**Reasons**	**Percentage/number**
They are shy	2.8%(1)	Cultural Influence	2.8%(1)
They feel they can work better alone	5.6%(2)	No idea	2.8%(1)
Girls are afraid of boys	2.8%(1)	They feel they Know everything	2.8%(1)
Cultural Influence	2.8%(1)	They feel superior	5.6%(2)
No idea	2.8%(1)	They don't follow instructions	5.6%(2)
They feel they know everything	8.3%(3)		
They feel superior	8.3%(3)		

Students' comfort in using computers

While many boys and girls in junior schools were comfortable with the use of computers, many students (76%: 25/33 males, 50%):18/36 females) were very comfortable. Three girls who said 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). The differences in comfort among the two sexes were not significant at 0.05 levels.

Students' worries in learning using computers

More boys (61%: 22/36 males) than girls (33%:12/36 females) were not worried when using computers in learning. A small number of girls of who indicated much worries said, " learning 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 computers (5)", "many instructions (1)" and "feeling that am not doing something right (1)". The differences among the two sexes were not significant at 0.05 levels.

Students' interaction in computer classes

Students were interviewed to seek information on how they cooperated and interacted among themselves in computer classes. In order to gather information on how boys and girls interacted in computer classes, information was sought to know whether both sexes worked together during computer lessons. Many girls (80%: 27/34) than boys (67%: 24/36) disagreed that boys preferred to work alone during computer lessons, indicating that few girls (20%) than boys (33%) were of the view that boys did not cooperate in computer classes. These views showed difference among the two sexes where more boys felt girls did not cooperate. Reasons were sought from 7 girls who said boys preferred to work alone and from 12 boys who said girls preferred to work alone, Tables 2(a) and 2(b). While both girls and boys gave different reasons, some similar views were noted. These were:" boys' feelings of superiority", "boys' claims of knowing everything" and

"cultural influences". The differences noted were not significant at 0.05 levels.

DISCUSSION

The general view by many students that they found learning using computers to be useful was a positive sign towards the use of technology in instruction. Some differences that put girls above average on usefulness were not significant. However, differences emerged on reasons why computers were usefulness where many boys found computers to be useful in searching for jobs, whereas many girls found them useful in internet access without mentioning reasons for access. Students of both sexes did not indicate the usefulness in particular contents of the study and a small percentage indicated usefulness in accuracy of answers and information. At the time of conducting the study, students (in form two) were expected to have covered knowledge in basic computer skills that involved keyboard skills, creating new documents and editing; word process and spreadsheet. The syllabus used at this level looked more general in design and reflected the responses of students who could not specify the usefulness in particular content areas of study. However, students' views that computers were useful could be considered as an appreciation to the use of technology in instruction. An earlier study in a number of schools in Botswana showed that students did not consider the use of calculators to be useful in learning (Kaino and Salani, 2004). Such a finding could 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.

The finding that girls had more anxiety in learning than boys concurred with some other researchers elsewhere though in some studies different findings have been documented in grades 7 to 11 where girls were less anxious than boys (King, Bond & Blandford, 2002). A deeper study on computer anxiety would be useful to establish whether anxiety was caused during computer classes or was a pre-existing computer anxiety as found in a study by Gaudron & Vignoli, (2002). It could also be found out whether anxiety was related to computer literacy and experience (Beckers & Schimidt, 2001; Bozionelos, 2001), the components that were not studied by this research. Also the findings of this study that there were good interaction and cooperation among students indicated a conducive atmosphere of learning between both sexes. Some studies have reported undesirable classroom environment for females to learn (Kaino, 1997; Anstey 1997; Jungwirth 1997). However, a deeper analysis was required to study interaction in instruction. Many studies have also indicated that the teacher was instrumental in creating conducive classroom setting for constructive learning and in providing a learning environment that was stimulating and orderly all the time (Cheng, 1993; Fraser, 1986). It was thus important to find out further whether teachers had an influence in a good cooperation atmosphere that was found between boys and girls in computer classrooms.

Concluding Remarks

Learning using computers was found useful by most students of both sexes and some differences on reasons of usefulness were consistent with other studies elsewhere on gender disparities. However, the nature of the computer curriculum used at this level of schooling, might had an influence on the usefulness of computers in learning. Boys' enjoyment in learning using computers with less or no anxiety than girls was also consistent with findings by other researchers. Anxiety found by this study among girls could not be related to enjoyment in learning using computers. Though gender differences were noted in anxiety and some differences on reasons for usefulness, there were indications that students had the opportunity to work independently to explore and discover knowledge. At the same time, students had the opportunity to work together, in a classroom environment they were comfortable with. It was therefore plausible that some aspects of the two constructs of learning, i.e. cognitive and social constructs were visible in instruction though further studies for deeper understanding are recommended. While the findings of this study could not be generalized to reflect gender attitudes in all schools in the country, it was felt that attention should be drawn to the following for further study: (i) the nature of computer studies curriculum that targeted particular content areas where learners could identify as useful, and (ii) teaching using computers that involved particular activities and exercises (from identified content areas) that could motivate students especially girls to feel comfortable in learning and enjoy computer lessons without anxiety.

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