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GENDER DIFFERENCES IN COMPUTER LITERACY AMONG UNDERGRADUATE STUDENTS AT THE UNIVERSITY OF BOTSWANA: IMPLICATIONS FOR LIBRARY USE

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ABSTRACT
This paper, presents findings of a study that was carried out in January 2006 at the University of Botswana to determine gender differences amongst undergraduates' students across all disciplines with regard to computer literacy. Five hundred students were surveyed of which 300 were females while 200 were male. The proportion of female to male students at the University of Botswana is 53%:47%. Purposive sampling was used to select respondents from the six faculties of the University; a survey questionnaire was administered to them and collected on its completion. Descriptive statistics and t-test were employed in the analysis of data. The results suggest that gender differences exist between female and male undergraduate students at the University of Botswana with regard to computer literacy. The findings further revealed that students with higher computer literacy were more inclined to access and make use of library facilities. Moreover, differences exist in the respondents' computer usage and software application. The paper discusses the implications of these results on the students' use of library.

Keywords: Computer literacy; Digital literacy; Information literacy; Gender differences; Library use; Undergraduates; Botswana.

INTRODUCTION

The University of Botswana became a full fledged university in 1982 having been part of the University of Basutoland, Bechuanaland and Swaziland (UBBS) established in 1964 to serve three countries of Lesotho, Botswana and Swaziland (University of Botswana 2005). The University of Botswana has six faculties namely, Business, Education, Engineering and Technology, Humanities, Science, Social Science and the School of Graduate Studies. During the 2004/05 academic year, there were 15,725 students enrolled at the University of Botswana of which 81% were fulltime, 17% part-time and 2% distance learners. Of the total student population, 52% are female while 48% are male. The distribution of students is such that 67% are enrolled in undergraduate degrees (University of Botswana 2005a).

The issue of gender equity as far as access to and use of ICTs continues to be a topical subject not only at the University of Botswana but the world over. This has been given impetus by the Millennium Development Goals (MDGs) that espouse gender equality by the year 2015. The MDG Goal 3 emphasises promoting gender equality and empowerment of women with specific targets to improve the education of women and girls (Development Gateway 2004). This declaration is made against the backdrop that access to and use of ICT remains extremely uneven between female and male in tertiary institutions especially in developing countries. For example, the Association of Africa Universities (AAU) Conference held in Nairobi, Kenya from 5th–12th February 2001 noted that poor quality of students, paucity of contemporary programmes and gender inequality were some of the problems that were preoccupying educators and policy makers. In particular, universities were producing graduates who were ill equipped for the world of work and consequently employers often re-trained staff in a time-consuming and expensive exercise (Aduda 2001).

One of the recurring themes in the underutilisation of ICTs is the lack of relevant competencies with females often cited as more affected than males. Aduda (2001) noted that of the myriad problems afflicting university education in sub Saharan Africa, was the lack of competencies, knowledge and skills on the part of students that are key in working in a rapidly changing technological environment were not being addressed. Similarly, Daly (2003) pointed out that university education in most developing countries especially those in Africa include technophobia, lack of prerequisite skills to manipulate new technology, and reluctance to switch from traditional methods of teaching to technology oriented approaches.

Computer literacy means knowing some basics of ICT to, for example, save and open a file, use a word processing program, and send and receive email for starters. Moreover, it means having some sort of level of comfort around computers rather than a having some fear or a feeling of foreboding (New York Times Company 2006). Idowu, Adagunodo, and Idowu (2004) indicate that knowledge, skills and confidence with computer technology are now an asset for those entering the competitive employment market. They point out that every aspect of life from education, leisure, and work environment to social interactions is being influenced by computer technology. Moreover, with the increasing use of ICT in education the world over, new skills and competencies among students are

required for them to effectively learn. For example, there are vast array of services that one can currently find online. These services are constantly growing, some of which are of general nature while others are specialised for students such as reference information on the Web that students can find of use that include news, weather, sports, movies, encyclopaedias, cartoons and games among others. As an educational and entertainment tool, ICT can enable students learn about virtually any topic, visit a museum, or play an endless number of computer games with other users. Moreover, for students to exploit ICT resources, effectively, there is need to be equipped with the requisite digital literacy competencies.

Tomas Rivera Policy Institute (2002) in the United States noted that students who did not have access to computers and the Internet (among other technologies) were likely to get further behind their peers who did have such access. Such deprived students would miss the instant links to information, entertainment, and communication. In addition, they would potentially miss out on the 70 percent of jobs that require moderate or high amounts of computer knowledge, all of which pay well and probably would end up in the 10 percent of low-paying jobs that do not require technical expertise (Linn 1999). With the increased use of ICT in society in general and schools in particular, it becomes imperative that students should be equipped with digital literacy competencies in order to exploit information resources that the electronic age engenders.

The importance of computer literacy especially in higher education does not need to be over emphasised. New York Times Company (2006) points out that in most places of business, a computer is a standard tool. Similarly, in the bank, computers are used to look up account information. Furthermore in the increasingly automated library environments, one cannot find books by looking in a card catalog but one must use a computerized database. The point here is that no matter where one finds employment, there is a good chance that a computer will be a basic tool one will have to use. It is therefore in the best interests of students to be computer literate both for the world of work and in enriching their studies both in high school and at the universities.

Within higher education, computer literacy is being recognised as an important component of the curriculum. The University of Botswana for example, has in the last five years strived to put in place mechanisms that would enhance information literacy in general and digital literacy in particular aimed at enhancing the quality of

learning processes. The issue of equipping students with adequate digital literacy skills to prepare them for the increasingly digital environment has long concerned the University of Botswana. In 2002/03, the University introduced general education courses (GECs) with high ICT component to address such cross-cutting issues as employers' expectations, competence in communication skills, computer and information literacy (University of Botswana 2005, 21) Similarly, the University implemented WebCT e-learning platform in 2002 with the aim to fulfill its responsibility of preparing students for effective participation in the workplace; provide the opportunity for the University to enhance flexible learning any time, anywhere and at student's own pace and provide customised individual learning preferences. Furthermore, it would enable students to explore learning materials with more senses (multiple modes and multi-media); provide an easy means of finding, handling, and publishing electronic materials. It was also expected that through e-learning, access to relevant national and international resources would be facilitated.

Though efforts that are being made to enhance digital literacy especially in higher institutions of learning the world over, no deliberate efforts are made to address the imbalance that exist between females and males, in spite of increasing documented research on gender imbalance that show that females react somewhat differently to computers and also have to deal with different conditions in society regarding these issues compared to their male counterparts (Enochsson 2005). This study was aimed at investigating gender differences in computer literacy of the University of Botswana undergraduate students and the implications for using the increasing computerised library resources.

CONCEPT OF COMPUTER LITERACY

Definitions of computer literacy abound in literature. Idowu, Adagunodo, and Idowu (2004) define computer literacy as the ability to make use of computer system to word process documents, analyse data, develop small computer programmes, browse Internet and install software. The Department for Education in the United State of America (1996) citing Hall (2005) observes that information literate individuals in addition to knowing how to use the computer for word-processing, spreadsheets and Internet access make use of increased learning opportunities provided by such technology. Mitra (1998) on the other hand perceives computer literacy as the amount of computer knowledge acquired in the past and the length of computer usage. Stone citing Idowu, Adagunodo, and Idowu

(2004) on his part focuses on vocabulary and programming as a means to computer literacy. Similarly, Loyd and Gessard (1984) conceive computer literacy based on the amount of the time spent on the computer, ownership of computer and number of computer related courses taken, while Francis and Katz (1998) define computer literacy as computer experience and use, programming skills and ability to use software. On the other hand, the Clinton Era Technology Literacy Challenge equated technology literacy with computer skills and the ability to use computers and other technology to improve learning, productivity and performance (U.S. Department of Education 1996, 5).

Hall (2005) perceives computer literacy in the context of four types of computer users, namely, the emergent user, the progressive user, the high user and the dependent user. Each definition describes a set of behaviours such as range of software use, frequency of use and reliance on use. The emergent user is characterised by having access to computer(s) at home or work. Moreover, such a user has access to, and knows how to use word processing, e-mail and web browsing software through designated University machines. The emergent user can also download information to diskette for printing elsewhere. The progressive users are those who are ready for whatever it takes them to have more knowledge of computer. They spend their time and money to learn more about the technology. The high users are those who are well verse in computer technology. They know how it works and how it can be manipulated. The dependant users on the other hand, are those who don't know anything about computer and not making an attempt to learn it. They depend on those who know much about computer to help them out in case they have something to do on computer. Kay (1993) developed a practical multicomponent computer ability measure (CAS) comprising all four areas of computer use or sub-scale involving software ability, awareness, perceived control and programming skills.

By and large, the vast majority of undergraduate students in universities in general, the world over, recognise the importance of computer literacy as the key for success in their personal and professional lives (Sanders and Morrisson-Shetlar 2001). Fisher (2000) in an investigation of computer skills of teacher education students found that 86% of them classified themselves as experienced computer users or as having some knowledge of computer software applications. These figures were likely to increase inline with computer usage in schools and at home. Similarly, Kay (1993) in a study of computer literacy level of pre-service teachers

reported that respondents rated themselves as having low knowledge and very low programming skills. Hignite and Echternacht (1992) also in similar study found that subjects tended to have a low literacy level, even though their attitudes towards computers were positive. Furst-Bowe et al. (1995) in related studies noted that computer literacy among academics in higher education showed considerable variation, yet it is assumed that all students will have a similar level of related skills on entering university. Furthermore, Furst-Bowe's study of computer literacy of students entering university reported that levels of computer literacy varied greatly amongst the respondents. Sweaney et al. (2001) recognised the need to be cautious in assuming that all students have had similar exposure to computers prior to entry into university education. Geissler and Horridge (1993) observe that variables such as computer experience, computer familiarity, computer use and computer ownership influenced self-reported levels of computer literacy.

GENDER AND COMPUTER LITERACY

Vygotsky (1986) noted from a socio-cultural perspective that knowledge is constructed and developed through communication with the environment. Similarly, James and Prout (1997) citing Enochsson (2005) noted that gender together with childhood are seen as cultural constructions and participating children are treated as participating subjects and co-constructors of data Consequently, the word gender does not necessarily mean that there are inherent differences between female and male in terms of preferences for technology. If there are any differences, they are based on hierarchical structures within the culture of what is suitable for boys and girls respectively (Johansson 2000; Walkerdine 1997). Kembler (1996) notes that Science and Technology is in no way separated from the cultural structures that treat women and girls unfairly compared to male counterparts.

Evans (1994) observes that gender is a fundamental category for ordering and classifying social relations in the world. Research has over the years shown that males dominate in the use of computer compared to women (Geissler and Horidge 1993). Similarly, even in situations where male and female are given equal access, men are more likely to be main computer user than women (Becker and Sterling 1987; Idowu, Adagunodo, and Idowu 2004). Traditionally, girls tend to be interested in computers, use them less often in their spare time and have more negative attitude towards computers (Barnert and Arbinger 1996; Brosnan 1998;

Metz-Goeckel et al. 1991; Okebukola 1993; Shashaani 1994). Consequently, the girls are often less computer literate than boys (Schaumburg 2001). Similarly, computer inexperience for female users has been cited as an important factor in determining their attitude and anxieties towards computers (Jenson 1999). As a result of the fact that men have a greater tendency to dominate available computer resources which is not being corrected, female have significantly lower experience levels than their male counterparts (Koch 1999).

The literature on the imbalance of computer literacy of female compared to male (in favour of male) advance some ways of addressing the problem based on how each of the genders view the computer. Research indicates that male students are very interested in how technology works while female students tend to focus on how the technology is used (Silver 2001). Teachers are reported to notice that boys seem happy to sit for hours with computers but end up playing computer games or messing around with the computer just to see what it can do. Girls, on the other hand, tend to want the computer to do something useful for them. This finding may suggest that girls will find the computer more attractive if it is presented as providing an easier or better way to do something they want or need to do (Women's Action Alliance 2001; Silver 2001). To stimulate the interest of all students, Silver, suggested that, the context in which the computer is used should be relevant to their needs and interests. Its long-term usefulness in a variety of areas should be emphasized and connections to real world application made.

Research has revealed the dominance of males in computer use and ownership (Miura 1997 cited in Idowu, Adagunodo, and Idowu 2004). Furthermore, studies that have examined the relationship between gender and computer attitude have reported that males tend to have more positive attitudes towards computers (Comber, 1997). Similarly, results of a computer competency test which included both theoretical and practical knowledge (Bain et al. 1991) showed that girls were slightly less competent than boys. Jackson et al. (2001) in a comparison of female and male computer literacy competencies found that females reported more computer anxiety, less computer self-efficacy, and less favourable and less stereotypical computer attitude. A similar study by Francis and Katz (1998) further revealed that gender stereotyping of computer use as a domain did not affect female students' attitude towards computer. This finding seemed to be corroborated by Smith and Necessary (1996) who in a related study found that males had a higher level of computer literacy than females.

OBJECTIVES AND METHODOLOGY

The objectives of this study in respect of the undergraduate students at the University of Botswana therefore are to:

1. Determine gender difference in computer literacy between male and female students
2. Establish gender differences in the computer literacy based on the numbers of hours spent on computer per week
3. Find out if there are gender differences in the computer literacy based on software and application use of computer system
4. Investigate how the level of computer literacy affects use of library.

The study employed a descriptive survey method which affords the researchers to describe the differences in the computer literacy of the undergraduate students based on gender. The population of the study comprised the regular undergraduate students of the University of Botswana spread across the six faculties of the University which consists of thirty nine departments. In the process of selecting the sample of this study, a census of faculty was taken. Within each faculty two departments were purposefully selected. This gave a total of ten (10) departments. From each of the selected departments 50 students were selected purposefully. This indicates that a total of 500 students were selected from the six departments that took part in the study. The demographic characteristics of the respondents revealed 200 as male and 300 as female, perhaps reflecting the proportion of female to male undergraduate students at the University of Botswana which stands at 7,416 (53%) for female and 8,294:(47%) for male, with a total stand at 15,718 in 2005/2006 academic session (University of Botswana Fact Book 2006). The data also showed that 125 were each selected from the years 1, 2, 3 and 4. The population of this study (500) is justified going by principle of sample selection by Israel (2003) which stipulated that in a population 15,000 if 5% is taken for precision the sample should be 390. The fact that the population of this study was greater than 390 stipulated by Israel's principle suggests that the population used in this study is justified.

The short questionnaire administered to the respondents comprised demographic variables and selected computer competencies such as word processing, Internet browsing, programming, playing computer game, ability to use e-mail, online public

access catalogue and analysis of data using relevant statistical software. It is a closed ended questionnaire with responses ranges from YES/NO and Likert type of four points rating in which the respondents were required to choose from the options Very often, Often, Rarely, and Never. The questionnaire consists of four sections based on the variables tested on the study. Descriptive and t-test statistics including percentages, means and standard deviation were computed.

FINDINGS AND DISCUSSIONS

The respondents surveyed were generally aged between 19-26 years with a mean age of 22.5 years. They were asked to state the lengths of their computer experience. The results in Table 1 indicate that the male students are more computer literate and had more computer experience than their female counterpart and suggest that gender difference exists in the computer literacy of the University of Botswana undergraduates as confirmed by the result of the mean and standard deviation analysis (X=0.71; SD= 8.5) compared with female with mean X=0.3 and SD= 5.4. This result corroborates the findings by Idowu, Adagunodo, and Idowu (2004) that where male and female are given equal access, men are more likely to be main computer user than women. Similarly, the computer inexperience of female as pointed out by Jenson (1999) is an important factor in determining their attitude and anxiety towards computers. At the university, anecdotal evidence suggests in general, that male students tend to dominate available computer resources more than the females.

Table 1: Gender difference in computer literacy and computer experience

Computer Experience/Year	Male	Female
0—1 year	20 (10%)	80 (26.7%)
1—2 years	29 (14.5%)	39 (13%)
2—3 years	35 (17.5)	45 (15%)
3—4 years	42 (21%)	58 (19.3%)
4years +	74 (37%)	78 (24.6%)
Total	**200**	**300**

Respondents were asked to state the number of hours that they used computers in a week. The results generally show there are differences in the male and female

number of hours spent using computer per week with male spending more hours than the female. While a considerable number of male students are spending more hours using the computer per week from 10-25 hours, more female students are spending lesser hour between 1-4 hours per week. The findings on the number of hours that both male and female students spent using computers per week as detailed in Table 2 suggest that significant gender differences exist in the computer literacy among the respondents. The results indicate that male respondents spent more hours per week on computer compared to their female counterparts. The fact that results from similar studies have shown that male students tend to be very interested in how technology works while female students focus on how the technology is used perhaps can explain the reason for this finding. Additionally, it has been found that boys seem happy to sit for hours using computers though they largely end up playing computer games or messing around with a computer just to see what it can do. Comber (1997) noted that male students have more positive attitudes towards computers while Jackson et al. (2001) found that female reported more computer anxiety, less computer self-efficacy, less favourable and less stereotypical computer attitude. All these may prevent them from spending hours with the computers as men do.

Table 2: Numbers of hours of computer use per week

Computer Use/No of Hrs/Wk	Male	Female
1—4 hours	08 (4%)	185(61%)
5—9 hours	20 (10%)	42 (14%)
10—14 hours	30 (15%)	28 (9.3%)
15—19hours	47(23.5%)	22 (7.3%)
20—24hours	55 (27.5%)	20 (10%)
25 hours +	40 (20%)	3 (1%)
Total	**200**	**300**

Respondents were also asked to indicate what computer applications they used. The overall results on the types of applications used are depicted in Table 3 and indicate that there is marked significant gender difference in application use of computer by male and female subjects. It is clear that male student engage in applications like word processing, Internet browsing, e-mail, data analysis, programming, and CorelDraw more than the female, except that the female do

engage in chat and games more than their male counterparts. This result as well can be linked to the issue of fear and anxiety attributed with computer by the female subjects, and may be responsible for their lower engagement in using computer software and applications.

Table 3: Gender difference in computer applications usage

Computer usage/software application.	Male	Female
Word Processing	28 (16.6%)	40 (13.3%)
Internet Browsing	55 (27.5%)	62 (20.6%)
E-Mail	47 (23.5%)	59 (19.6%)
Games	12 (6%)	50 (16.6%)
Chat	10 (5%)	65 (21.6%)
Data Analysis	20 (10%)	8 (2.6%)
Programming	17 (8.5%)	6 (2%
CorelDraw	11 (5.5%)	10 (3.3%)

The results from the study were further analysed using mean and standard deviation on each of the applications that respondents used. On computer experience, mean for male was 0.71 while for female was 0.30. On the other hand, on computer experience, the standard deviation for male was 8.50 while for female was 5.40. As far as computer usage and hours spent per week were concerned, mean for male was 0.70 and for female 0.30. Similarly on computer usage and hours spent per week, the standard deviation for male was 7.60 while for female it was 5.00. The overall results are depicted in Table 4. The results of correlations generally show that gender difference exists in the computer literacy of the subjects based on their computer experience with the mean of male (X= 1.71; SD=8.50) compared to the female with (X=0.3; SD 6.40) and computer usage/ number of hours spent with males having (X= 2.70; SD= 7.60) compared with the female (X= 0.3 and SD =5.0).

Table 4: Descriptive statistics and correlation on computer use/experience

Computer Experience	Male	Female
Mean	1.71	0.30
Standard Deviation	8.50	6.40
Computer usage/Hrs spent	Male	Female
Mean	2.70	0.30

Standard Deviation	7.60	5.00

The means and standard deviations on software and applications between male and female were also computed. The results in Table 5 generally show that male significantly use applications like Internet browsing, data analysis, programming and CorelDraw than the female while the female on the other hand use game and chat than the male. However, no gender difference exists in the use of word processing and e-mail.

Table 5: Mean/Standard Deviation for Application Use (Male/Female)

Software &Applications Use	**Male**		**Female**	
	Mean	Std. Dev.	Mean	Std. Dev.
Word Processing	0.17	0.4	0.06	0.24
Internet Browsing	1.2*	0.5	0.09	0.29
E-Mail	0.1	0.3	0.07	0.26
Games	0.1	0.3	1.04 *	0.28
Chat	0.02	0.14	1.08 *	0.29
Data Analysis	1.02 *	0.14	0.004	0.05
Programming	1.16 *	0.13	0.006	0.08
Corel Draw	1.24 *	0.16	0.012	0.18

*significant

The findings in Table 4 and 5 further confirmed the difference in computer experience and computer usage of the respondents as earlier revealed in Table 1 and 2. The confirmation reflects in the mean and the standard deviation computed. Table 4 shows that the mean and standard deviation of male is greater than that of the female on both computer experience and computer usage. This lends a good credence to the report by Bain et al. (1999) that girls were slightly less competent than boys in computer competency test. The lesser software or application use of computer as revealed in this study therefore can be attributed to the female subjects' lesser competency level.

Having derived the mean and the standard deviation, further effort was made to evaluate hypotheses on significant differences among the male and female students' computer experience and usage. The t-test performed in Table 6 contains the detail. The results reveal that significant difference exists between

students computer experience based on gender with the male students having more experience than the female (Male: Mean = 1.71, SD =8.50; Female: Mean 0.30, SD =6.40; t.obs =1.99 and df =498). Furthermore, Table 6 indicates that significant difference exists in the hours spent on computer with the male again spending a considerable numbers of hours than their female counterpart (Male: Mean =2.70, SD =7.60; Female: Mean= 0.30, SD = 5.00; t.obs = 4.00 and df= 498).

Table 6: T-test of gender comparison on computer experience and hours use on computer

Variables	No	Mean	SD	Df	t.obs	t.crit	Remark
Male Computer experience	200	1.71	8.50				
Female Computer Experience	300	0.30	6.40	498	1.99	1.96	S*
Male's hour spent on Computer	200	2.70	7.60	498	4.00	1.96	S*
Female's hour spent on computer	300	0.30	5.00				

Respondents were also asked to indicate whether their level of computer literacy enhanced their library use. Similarly, they were asked whether their computer literacy was sufficient for them to use the Online Public Access catalogue (OPAC) and Internet. The results show that 170 (85%) males felt that their literacy level affected their use of the library as compared 86 (28.7%) females who felt their computer literacy enhanced their library use. Similarly, 189 (94.5%) males as opposed to 90 (30%) females were able to use the Internet and the OPAC with their current level of computer literacy (Table 7). The result revealed clearly that the gender difference in the computer literacy level of the subjects really affect the female subjects as they find it difficult to use or access some library facilities like the OPAC. This is because a considerable number of female subjects indicated that they were unable to use the library in recent time due to their deficiency in the use of computer. It should be noted at this point that library nowadays has gone beyond the level of mere depository of books. It has been pointed out in the literature review that information technology has revolutionalised all library activities and operations. This means that any user who wants to make effective

use of the library need to be equipped with the knowledge of computer and ICT skills.

Table 7: Computer literacy and library use

	Item	Male		Female	
		Yes	No	Yes	**No**
1	Does your computer literacy enhance use of Library?	170 (85%)	30 (15%)	86 (28.7)	214 (71.3%)
2	With your present computer literacy level, were you able to use for example the library OPAC and the Internet	189 (94.5%)	11 5.5)	90 (30)	210 (70%)

Limitations and Implication

The scope of the study was limited to undergraduate students across all disciplines at the University of Botswana. Further research to determine the impact of disciplinary backgrounds would be useful in designing and implementing computer literacy programmes at the University of Botswana.

The University of Botswana library has automated largely its information processing and retrieval functions with most of databases provided online. Students are expected to be proficiency in their computer literacy in order to make effective use of these library facilities. However, there is no systematic and comprehensive training that is provided to ensure that such resources are utilized effectively. The outcome of this study should provide a framework for designing computer literacy interventions that the resources are exploited to the full.

CONCLUSION

The purpose of this study was to determine the gender differences among undergraduates at the University of Botswana with regard to their computer literacy. The findings from this study is generally a wake up call of the need to acknowledge the fact that male and females learn in different ways and the need to match computer training to females cognitive structures The findings demonstrate the need for all University of Botswana undergraduates to be adequately equipped with computer literacy competencies for their effective use of the largely computerised library facilities on campus. Moreover, the introduction of

information literacy courses (GEC) as they are called in 2002/2003 academic year is an effort considered to improve the information literacy of the University of Botswana undergraduates. This is an effort in the right direction. It is hereby suggested that this should be more focused and enhanced and the authority should ensure that all the necessary support is given to further enhance the teaching of the GEC courses.

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