Gender Differences and Technology Usage amongst Postgraduate Students in a Christian University

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Abstract: One research focus area that has recently received greater attention in developing countries is gender equality in Information and Communications Technology (ICT) use at postgraduate level. At face value, post graduate students offer a well-defined group wherein to study ICT effects. Furthermore and often overlooked, is the ethos of Higher Education Institutions (HEIs) where such gender studies are conducted. Most HEIs are higher public or private institutions. The former are mostly state-run, more accessible, and generally more liberal in both teaching and learning. The latter are independent entities who set their own and very specific rules and regulations. This exploratory study took place in the context of a private Christian-based Higher Education Institution in a developing country involving Nigeria, with the purpose to examine, at post-graduate level, gender differences in hardware and software used for general and class work purposes, as well as gender-specific relationships between selected ICT use constructs and class marks. Negligible gender gaps pointed at no significant gender differences in hardware and software use. Positive and significant correlations were reported between class marks and selected constructs. Teaching with the aid of ICTs, Student engagement and Student use of ICTs, suggests that active use of ICTs has a profound impact on both teaching and learning at postgraduate level, and ultimately on student performance and achievement.

Keywords: Christian Private University, Class marks, Gender Differences, ICT use, Student Academic Achievement and Postgraduate Students.

1. Introduction

In recent years gender studies have reflected an aspect of life which gains massive benefits from the utilization of technology (Nur-Mustafa, 2014). In Africa, however, of the limited demand-side data that exists, very little is disaggregated on gender lines (Gillwald, Milek and Stork, 2010). As the authors furthermore noted, intractable limitations to equitable access and use of Information and Communication Technologies (ICTs) in cultural and social dimensions, including education, still remain. This lack of data is affirmed by Trucano (2015) who notes that many of the research questions defined a decade earlier by the World Bank's infoDev program (see Trucano, 2005; InfoDevWorldbank, 2015), inclusive of understanding the gender impact of ICTs in education on access, use of, attitudes toward, and learning outcomes in developing countries, continue to resonate. Simply put, the author states that "we still do not know answers to a lot of the basic questions".

In the wider educational sphere, gender differences have been recorded in terms of classroom interaction, teaching practice, skills acquisition, information literacy behavior, professional development and reading habits (Funmilayo, 2013; Gargallo-Castel, Esteban-Salvador, Pérez-Sanz, 2010; Becta, 2008). One research focus area that has recently received greater attention in developing countries is gender equality in ICT use at postgraduate level. At face value, post graduate students offer a well-defined group wherein to study ICT effects, for two reasons: (1) being older, but still part of the Millennial Generation, they are expected to have had more exposure to the use of ICTs, thereby improving statistical reliability of reported effects; and (2), by demonstrating a capacity and dedication for independent learning at this level, the use of a wide variety of learning strategies, which ostensibly invites the use of ICTs, is expected of students.

In this paper, we report on a gender and ICT use study conducted at a private HEI situated in Nigeria, which is a developing country. As is the case with many private HEIs in Nigeria, the proprietorship of this HEI belongs to a church with established rules and regulations that are based on Christian values. These rules and regulations extend to the use of all facilities used in teaching and learning. As alluded to, this is in stark contrast to public HEIs where some level of freedom in the use of ICTs exists. In Nigeria, just as in other African countries, religion, culture, tradition and other factors have broaden the discrepancy between Nigerian male and female at the expense of female (Sanda & Kurfi, 2013). Odufuwa (2012), for example, reported female usage of computers in Nigeria to be between one-third and one-quarter that of their male counterparts. Given the above, a suitable setting for investigation is thus created.

The first objective of this study is to determine if there are significant gender differences in ICT usage among postgraduate students in a Nigerian private HEI where a Christian character is central. Specifically, it seeks to examine differences between females and males in terms of hardware such as PC/Laptops, Tablets and iPads, Smartphones, and software which includes Word Processing, Spreadsheet, Database, SMS, Email, Webmail, Webinars, Internet, the use of eBooks, Learning Management System and mobile learning offerings. A second objective was to establish the gender impact the use of such ICTs had on student academic performance.

The rest of the paper is structured as follows: Section two discussed related works. Section three covers the research design and methods, inclusive of the research questions of the study and the theoretical framework underlying the research. Section four presents the results from the data analysis. A brief discussion of results is presented in session five.

2. Related Work

Given the objectives of the current study, a total of 18 relevant studies were reviewed. Key totals are as follows: developing countries = 9; developed countries = 11; developed countries at postgraduate level= 1; developing countries at postgraduate level = 5; and developing countries at postgraduate level based on religion = 1.

Broad-spectrum investigations at post graduate level in developing countries with no indication of religious affiliation reported males to be more likely to use computer technologies (Mahmood, 2009). The same bias was reported in a further study on the use of internet facilities, ebooks and reference books (Funmilayo, 2013). No differences in ICT usage was reported by Horvat, Oreski and Markic (2011), M.Ahmed (2015) and Wong & Hanafi (2007). In terms of ownership of the institution only one, by Mahmood and Bokhari (2012), listed proprietorship based on spirituality. Here no gender difference was reported. A small number of studies have considered ICT usage at post graduate level in developed countries, the most notable Barret and Lally (1999) who reported a bias in favour of males.

In Nigeria, more than 50% of universities are owned by religious bodies. The spiritual teachings and values provided by such knowledge may have a role to play in the use of ICTs with respect to gender, coupled with the fact that a large number of the universities are privately-owned and running undergraduate programmes. Undergraduate students are much younger and may easily be susceptible to ICT usage adherence compared to their postgraduate counterparts. It is therefore essential to also review gender difference studies in terms of technology usage at undergraduate level. Studies conducted at undergraduate level in developing countries reported no gender difference (Efuwape & Aremu, 2013; Wong & Hanafi, 2007, Suri and Sharma, 2013). When hardware, software, mobile and internet usage, and e-learning were of interest, two studies reported a female dominance (Dayıoglu and Turut-Asik, 2004; Chinyamurindi, & Shava, 2015), and one study a male dominance (Ikolo and Okiy, 2012). In developed countries, results are equally mixed, with a technology-usage dominance reported in favour of males (Appianing & VanEck (2015), females (Zhou and Xu, 2007; Cuadrado-García et al (2010), or no difference (Milis, et al, 2008; Kay, 2006).

In summary, there thus exists a gap in our knowledge on gender differences in ICT use at postgraduate level at private HEIs with a Christian character in developing countries.

3. Research Design and Methods

3.1 Research statement

The main purpose of the current research was to investigate gender differences in ICT use and the impact thereof on postgraduate student performance at a private HEI with a Christian character in a developing country. ICTs are classified as an Information System and with a focus on student use of ICTs in an educational process, the study therefore positions itself in the field of Technology Enhanced Learning.

3.2 Research questions

In order to meet the objectives of the current study i.e. to determine whether there are significant gender differences in ICT usage, and to establish the gender impact the use of such ICTs had on students' class marks, the following three research questions were formulated:

Research question 1: What, if any, gender differences exist in hardware and software used for general or class work purposes?

Research question 2: What gender-specific relationships exist between selected ICT use constructs and class marks?

3.3 Research methods

The philosophical base adopted was a positivist perspective with the aim to objectively explain and predict. Given the positivist perspective, the study adopted the quantitative research paradigm (Miles and Huberman, 1994) that lent itself to statistical analysis of collected data and a deductive approach (Dudovskiy, 2016). Clearance for the study was requested and received from the relevant ethical committees.

Seventy-seven survey questions were sourced from previous studies on ICT use in education. In order to ensure relevance, the researchers modified a few questions based on their own experiences with and theoretical sensitivity about the use of ICTs in education, and added few questions of their own. Construct A: Personal Information contained eight demographic questions. In Construct *B:* Teaching with the aid of ICTs, seventeen items were formulated by the researchers, and two items were adapted from Joseph, *et al.* (2015); and Dhanarajan (2002). For Construct *C:* Student engagement, fifteen items were adapted from Chenoby (2004); Kee and Samsudin (2014), resulting in three sub constructs: *C1: Individual attitude* (6 items); *C2: Diligence* (12 items); and *C3: Preferences and interest* (7 items). For Construct *D:* Student knowledge and skills, nine items were adapted from Passey, Rogers, Machell and McHugh (2004); and Wit, Heerwegh and Verhoeven (2012), while eleven items were derived by the researchers. In Construct E: Challenges of ICT use, seven items were derived by Akbar (2013), Adomi and Kpangban (2010) and Sam, Othman and Nordin (2005); and Adomi and Kpangban (2010). The remaining six items were derived by the researchers. Items were ranked using a five-point Likert-scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To explore the gender differences and impact between the construct items and class mark achieved, multiple linear regression analyses using Statistical Analysis System (SAS) JMP v.12 were conducted. The analysis path consists of questionnaire design, content validity, pilot field study, analysis of pilot data, main field study, testing of reliability (Cronbach's alpha), validity (factor analysis), review of construct, reliability analysis of final construct, final data analysis, interpretation and reporting.

3.4 Theoretical framework

The initial theoretical framework consists of the following constructs and sub constructs: Construct A: Demographics; Construct B: Course Activities: B1: Teaching With the Aid of ICTs, B2: Presentation & Discussion of Class Work with ICTs, B3: Suitability of Class Work for ICT Integration; Construct C: Student Engagement: C1: Individual Attitude, C2: Attentiveness, C3: Diligence, C4: Preferences and Interest; Construct D: Student Knowledge and Skills : D1: Exposure to ICTs, D2: Student Use of ICTs, D3: ICT Competence, D4: Personal Skills; Construct E: Challenges of ICT Use: E1: Anxiety over Use of ICTs, E2: Privacy, Safety and Security Issues, E3: Barriers to Use of ICTs. The independent variables are represented using Construct A to E, and the dependent variable was student academic achievement.

Figure 1 presents the final research model derived at after initial and exploratory statistical analysis procedures were conducted, which resulted in some sub constructs dropped, or moved or combined.

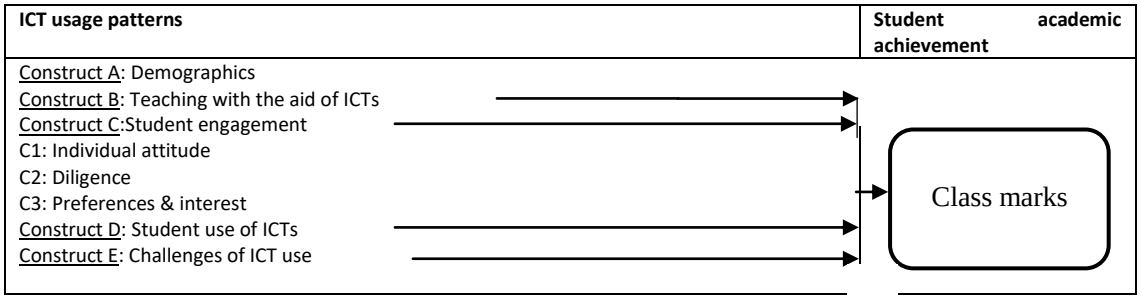

Figure 1: Theoretical framework

3.5 Research setting

The Master's class is a postgraduate three semester (eighteen months) programme. Research methodology is one of the courses offered by the Master's students across all departments at the HEI under study. The programme is attended by students from nine different departments, with a variety of instructors presenting the course. In preparation for a final research project to be delivered in the 3rd semester, the 1st and 2nd semesters focuses on course work. The 2nd semester of 2016 was used to collect data. The class mark consisted of four combined and instructor-assessed components: a class test mark, an assignment mark, a project mark and a presentation mark.

4. Data Analysis and Results

From a total of 320 questionnaires distributed, 302 were returned for a response rate of 94%.

4.1 Measuring reliability

To establish internal consistency, the reliability of the new constructs was measured using Cronbach's alpha. The following coefficients were reported: Construct B: Teaching with the aid of ICTs (0.969), Construct C: Students engagement (0.934), Construct D: Student use of ICTs (0.967), and Construct E: Challenges of ICT use (0.963). All the values were greater than 0.8, which is indicative of excellent results (Bhatnagar, Kim and Many, 2014).

4.2 Demographical data

Table 1 lists the age groups of students by gender. The majority of students (45.03%) were in the age group 21-26, with 25.17% male and 19.87% female. The next age groups containing the highest number of students were ages 27-32 (36.42%), with 20.53% male and 15.89 % female. Combined these two age groups (45.03% and 36.42%) represented 81.45% of the data collected. Across age groups, there were more males (57.28%) than females (42.72%).

Table 1: Variables and items for age group by gender

	Gender					
	Male		Female		All	
Age group	N	% of Total	N	% of Total	N	% of Total
21-26	76	25.17%	60	19.87%	136	45.03%
27-32	62	20.53%	48	15.89%	110	36.42%
33-38	25	8.28%	13	4.30%	38	12.58%
39-44	5	1.66%	5	1.66%	10	3.31%
45-50	2	0.66%	2	0.66%	4	1.32%
51+	3	0.99%	1	0.33%	4	1.32%
All	173	57.28%	129	42.72%	302	100.00%

There was similarity for male and female students in academic performance, as measured by mean class marks achieved (Table 2) – 61% versus 60%.

Table 2: Academic performance by gender

Level	N	Mean Class mark
Male	173	61.1214
Female	129	60.1938

Predictor: Gender. Depended variable: Class marks

4.3 Research questions

Research question 1: What, if any, gender differences exist in hardware and software used for general or class work purposes?

Table 3 presents gender differences as it relates to the use of hardware and software.

Table 3: General ICT hardware and software use by gender

HARDWARE	Male (n)	Female (n)	% Gap	SOFTWARE	Male (n)	Female (n)	% Gap
PC/Laptop (% of use)	100	100	0	SMS (% of use)	100	99	1
None	0	0		None	0	1	
Use	173	129		Use	173	128	
Total	173	129		Total	173	129	
Tablet (% of use)	96	95	1	Email (% of use)	99	100	-1
None	7	7		None	2	0	
Use	166	122		Use	171	129	
Total	173	129		Total	173	129	
Smartphone (% of use)	99	99	0	Webmail(%of use)	74	61	13
None	None	1		None	45	50	
Use	172	128		Use	128	79	
Total	173	129		Total	173	129	
iPad (% of use)	**79**	**75**	**4**	Webinars (% of use)	47	43	4
None	36	32		None	91	74	
Use	137	97		Use	82	55	
Total	173	129		Total	173	129	
SOFTWARE							
Word Processing (% of use)	100	98	2	eBook	81	80	1
None	0	2		None	33	26	
Use	173	127		Use	140	103	
Total	173	129		Total	173	129	
Spreadsheet (% of use)	94	96	-2	LMS e.g. Moodle (% of use)	71	67	4
None	10	5		None	51	43	
Use	163	124		Use	122	86	
Total	173	129		Total	173	129	
Database (% of use)	90	87	3	Mobile learning (% of use)	78	78	0
None	18	17		None	39	28	
Use	155	112		Use	134	101	
Total	173	129		Total	173	129	
Internet(% of use)	98	99	-1				
None	3	1					
Use	170	128					
Total	173	129					

With the exception of webinar software use (P-value = 0.0183, $p<0.05$), no significant gender differences were reported for both hardware and software use with $p > 0.05$. All students, both male and female, make use of a PC or a laptop (Gender Gap (GG) = 0). For other hardware, the percentage of use is slightly lower for smart phones with 99% for both males and females (GG = 0), while for tablets is 96% for males and 95% for females (GG =1). For iPads, the percentage of use is 79% for males and 75% for females. In terms of software use, a similar pattern of minimal gender difference was reported.

Research question 2: What gender-specific relationships exist between selected ICT use constructs and class marks?

In order to find answers to the research question above, Spearman's correlation coefficients were calculated. The results are presented in Table 4 for males and Table 5 for females. For males, with the exception of Construct E: Challenges of ICT use, all constructs returned significant and positive correlations with class marks. Construct B: Teaching with the aid of ICTs (0.805) returned the highest correlation. The next highest correlation achieved was for Construct D: Student use of ICTs (0.783). The lowest positive correlation was reported for Construct C: Student engagement (0.738). Construct E: Challenges of ICT use, recorded a negative correlation, which suggests that with an increase in ICT challenges, student academic performance (class marks) decreases. All the results were significant at $p < 0.05$.

Table 4: Construct correlation coefficients, Male

Variables	Construct B	Construct C	Construct D	Construct E	Class mark
Construct B: Teaching with the aid of ICTs	1				
Construct C: Student Engagement	.795*	1			
Construct D: Student use of ICTs	.712*	.708*	1		
Construct E: Challenges of ICT use	-.333*	-.277*	-.290*	1	
Class mark	.805*	.738*	.783*	-.203*	1

*significant at p<0.05 (Spearman's correlation coefficients)

For females, with the exception of Construct E: Challenges of ICT use, all constructs returned significant and positive correlations. Construct B: Teaching with the aid of ICTs (0.846) returned the highest correlation with instructor-assessed class marks. The next highest coefficient recorded was for Construct D: Student use of ICTs (0.852), followed by Construct C: Student engagement (0.819). Again, Construct E: Challenges of ICT use, recorded a negative correlation. It is noted that the positive coefficients reported for female constructs are higher than for male constructs, with only the negative coefficient for females lower.

Table 5: Construct correlation coefficients, Female

Variables	Construct B	Construct C	Construct D	Construct E	Class mark
Construct B: Teaching with the aid of ICTs	1				
Construct C: Student Engagement	.741*	1			
Construct D: Student use of ICTs	.657*	.811*	1		
Construct E: Challenges of ICT use	-.313*	-.332*	-.358*	1	
Class mark	.846*	.819*	.852*	-.341*	1

*significant at p<0.05 (Spearman's correlation coefficients)

It implies there is no gender impact with respect to class marks, and that the significant correlations reported between some constructs and class marks are not because of gender effects but technology use.

5. Discussion of Results and Conclusion

The main purpose of the current research was to investigate gender differences in ICT use and the impact thereof on postgraduate student performance at a private HEI with a Christian character in a developing country. Most notably, no significant gender differences in hardware and software use were found. This finding is in contrast to the results of previous studies by (Mahmood and Bokhari (2012) and Aesart and Braank (2015), who both reported an ICT use gap in favour of females. The results furthermore contradicted studies in favour of males as dominant ICT users (Kayany and Yelsma, 2000; Dorman, 1998; Adamus *et al*., 2009; Mahmood, 2009). The results, however, are in agreement with a study on access and usage of hardware and software by Mahmood and Bokhari (2012), where proprietorship was also based on spirituality. An agreeable outcome was also accorded to in Horvat, Oreski and Markic, (2011) on Internet usage.

The positive and significant correlations reported between class marks and Construct B: Teaching with the aid of ICTs, Construct C: Student engagement and Construct D: Student use of ICTs suggest that active use of ICTs has a profound impact on both teaching and learning at postgraduate level, and ultimately on student performance and achievement. The contrary is then also true i.e. inactive use will also impact on student performance and achievement. The latter is confirmed by the negative and significant correlation found between class marks and Construct E: Challenges of ICT use. That is, with a rise in ICT use challenges academic performance is negatively impacted. The highest correlation reported for Construct B: Teaching with the aid of ICTs is consistent with Bai, Mo, Zhang, Boswell & Rozelle (2016)'s interpretation that an ICT programme is more effective when it is incorporated into a classroom's teaching programme.

These results may partly be explained by the notion that compared to undergraduate students, postgraduate students will naturally have a higher level of ICT experience and use. From this perspective, ICT experience is then seen as a factor that reduces the gender gap reported in previous studies. Another contributing factor forwarded is the ethos of the HEI under study. As a private church-owned entity, a main purpose is to produce a new generation of leaders who embrace, in the current case, Christian values. Contrary to most public HEIs were students have more freedom in terms of self-determination, the conformity pursued is intended to nurture personal and professional values such as diligence and integrity. If such values are indeed transferred

to students, then the negligible gender gaps in ICT use are perhaps partly explained. As established by Vekiri (2010), perceived teacher expectations are positively associated with students' ability beliefs, with meaningful learning activities a significant predictor of students' interest in computing.

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