Hindawi
Education Research International
Volume 2023, Article ID 6555823, 13 pages
https://doi.org/10.1155/2023/6555823

Research Article

Revisiting Gendered ICT Attitude and Self-Efficacy: A Study of Technical University Students in Ghana

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Received 14 August 2022; Revised 6 June 2023; Accepted 17 August 2023; Published 15 September 2023

Academic Editor: Shuaian Wang

The existence of gender differences in the use of information and communication technology (ICT) impedes the attainment of gender equality and female empowerment. It is therefore essential to provide up-to-date knowledge on the gender ICT divide given that insight into ICT use by gender is often limited and not regularly updated, particularly for low- and lower-middle-income countries. Consequently, this study investigated gender differences in ICT usage, self-efficacy, attitude, and anxiety among technical university students in Ghana. The study is based on primary data conveniently collected from 409 students in a 3-year Higher National Diploma awarding technical university in Ghana using a self-administered questionnaire. Data were analyzed using descriptive statistics, Mann–Whitney *U* tests, and ordered logistic regression. Male students, compared to their female peers, reported frequent use of ICT, have a more confident and positive attitude, and are less anxious about the use of computers and their related applications. Access to computers and students' level of study were related to attitude and perceived ICT self-efficacy. Policymakers and administrators of higher education institutions should implement interventions to improve female self-confidence and the use of computers and their applications.

1. Introduction

Information and communication technology (ICT) is critical to meeting the demands and expectations of the 21st-century globalized economy and digitalized society [1]. Even though the concept became popular in the 1990s, it was mostly associated with being computer literate as well as having the ability to manipulate handheld devices such as tablets and phones [2]. However, in present times, the definition of ICTs includes a wide range of technologies such as TV, radio, electrical and power systems, telecommunications, computers, and the Internet [3]. ICT encompasses anything that makes the delivery and use of information possible [4]; nonetheless, it is not a neutral tool that has a universal effect but rather can be examined in contextual instances [5]. In the context of this study, ICT is classified broadly to include the use of application programs (Microsoft Word, Excel, and so forth), general computer usage, telecommunication devices, the Internet, and social networking among university students.

ICT literacy and competency have become critical success factors for college graduates in the competitive job market [6]. It is therefore not surprising that the worldwide educational sector has reacted positively to the needs of the 21st century by integrating ICT into educational settings to the point where it is increasingly difficult to envision classrooms completely free of at least some form of modern digital technology [7]. All over the world, the integration of ICT into the higher education sector is growing [8], aimed at revolutionizing teaching and learning [9], and subsequently contributing significantly to the successful operations of institutions of higher learning [10].

To keep pace with global technological advancement, from a relatively ground zero, ICT investment in Africa has witnessed substantial improvement over the years. Regionally, in 2017, West Africa accounted for $933 million,

or 41% of total ICT investment in Africa. Southern Africa received 23%, followed by North Africa (12%), East Africa (10%), and Central Africa (6%) [11]. Integration of ICT in education facilitates effective teaching and learning [12], provides curricular support [13], transforms an outmoded educational system [14], promotes graduate employability [15], eliminates geographical barriers [16], and helps students compete and survive financially [17].

The proliferation of ICTs across all economic sectors, such as construction, manufacturing, agriculture, hospitality, and other general services, is placing new demands on workers' skills [18] and creating greater expectations of graduates [19]. In today's job market, basic ICT skills are essential for people entering the workforce and for those trying to find a better job. ICT proficiency is a prerequisite to securing professional employment, and ICT skills enhance the chances of securing higher-paying jobs [20]. For instance, the employability of hospitality graduates relates to their competency and skills in spreadsheets [19].

In tandem with the increasing integration of technology in education, considerable research has been conducted on ICTs in institutions of higher learning, focusing on self-efficacy, attitude, and anxiety [21]. One stream of research in computer education scholarship that has attracted substantial attention for the past four decades is the gender ICT divide, highlighting gender differences in self-efficacy, attitude, usage, and anxiety among students [21–23]. Despite the enormous research output, conclusions on the relationship between gender and ICT remain inconsistent [24–27]. Some studies have reported insignificant gender differences in ICT attitudes [21, 28], while others have indicated that males exhibit more favorable attitudes toward ICT than females do [29]. Such inconsistencies on the subject derail strategic and policy efforts to bridge the gender digital divide. Given that digital competency has the potential to help bridge global gender inequality, it is critical to provide insight into the state of the digital gender divide among technical university students that will help managers of higher education institutions formulate interventions.

More recently, Fatehkia et al. [30] pointed out that data on ICT use by gender is often limited and not regularly updated, particularly for low- and lower-middle-income countries. A significant number of the studies examined the gendered ICT divided concerning usage, self-efficacy, attitude, and anxiety separately. In addition, existing studies on the gender divide in ICT concentrate on university students without specifically focusing on technical university students. Technical universities typically offer specialized programs in science, technology, engineering, and mathematics fields, which are particularly relevant to ICT careers and education. Given the inconsistent findings, coupled with inadequate and irregular knowledge of the ICT gender conundrum from developing countries, this study contributes partially to filling the identified gap and providing up-to-date knowledge by examining ICT and gender differences with usage, self-efficacy, attitude, and anxiety among technical university students in Ghana. Results from this study will make a significant contribution to the ICT and gender divide literature from a developing country perspective. Additionally, policymakers and higher education administrators will immensely benefit from understanding the nature and degree of gender ICT attributional differences in higher education institutions. The findings will be useful to improve the overall ICT access and quality of higher education and the computer literacy skills of students.

2. Literature Review

2.1. Ownership and Usage of ICT. ICT ownership and nature of use are paramount to the effective integration of ICT into teaching and learning in higher education [31]. Ownership and accessibility of ICT-related tools and applications have seen significant growth among university students all over the world [31]. Computer ownership among the University of Massachusetts-Amherst students expanded from 30% in 1991 to 45% in 1996 [32]. Another study conducted by Kennedy et al. [33] indicated that close to 79% of the 2,120 surveyed students had access to ICT gadgets such as mobile phones, desktop computers, and the Internet. Similarly, Gulatee et al. [34] found that 78% of the 977 students enrolled across all fields of study in the universities of Sakon Nakhon Rajabhat and Nakhon Phanom in Thailand owned laptops. Gosper et al. [35] investigated university students' ownership of computers in 2010 and 2013, and the results indicated that 96% of the participants had access to a laptop or desktop computer at home. Finally, computer ownership among students at the College of Health Services at the University of Ghana in Ghana was estimated at 82.5% [36].

University students use ICT gadgets for several purposes, including editing text, playing music, creating multimedia presentations, sending or receiving emails, browsing for general information, and accessing reference information for educational purposes [37]. Other forms of usage include using internet search engines and library tools to access online educational resources, Facebook, and learning management system applications for educational purposes [35]. About one-third of the 36,950 students across the United States in the study by Smith et al. [38] used web-based word processors. In a study of university students in Ghana, accessing social network sites and downloading music and videos were the top-most uses of computers, whereas the use of specialized software such as the statistical package for social sciences (SPSS) was low [39].

Researchers have examined gender differences in computer experience and usage. Results of earlier studies conducted in the 1990s and 2000s have generally reported wide gender gaps in favor of males across all levels of education [40, 41]. However, conclusions from contemporary studies regarding the gender digital divide are mixed. Some studies [42–44] have reported insignificant differences regarding access and use of computers among males and females, to the extent that others have found females demonstrating higher levels of computer use experience than males [45, 46]. On the contrary, a more recent study involving 209 older Korean Americans found males use computers more

frequently than females [47]. Similarly, results of other post-secondary studies have reported higher computer usage among males than females [48, 49].

There has been phenomenal growth in the use of social media networks among different categories of people in both developed and developing countries. About two-thirds or more of all adults in the US, Australia, South Korea, Canada, Israel, and Sweden use social media, while as of 2017, about 53% of adults across emerging nations use social media [50]. In 2016, in the US, 79% of online adults used Facebook, 32% used Instagram, 24% used Twitter, and 29% used WhatsApp or something similar [51]. In a Ghanaian university sample, more than half of the students reported regular use of WhatsApp, followed by Facebook, Twitter, and Instagram [52]. Gender differences in social media use have been examined. A large study conducted in 2015 found that girls dominated the use of Instagram and Snapchat in the United States [53], and similar gender disparity in the use of these social network sites is reported in more recent studies [54, 55].

2.2. Gender and ICT Self-Efficacy. Self-efficacy highlights beliefs in one's ability to organize and implement or execute courses of action. In the context of social cognitive theory, Bandura [56, p. 391] defines self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances." ICT self-efficacy encompasses internet self-efficacy and computer self-efficacy [57]. Similarly, internet self-efficacy is defined as a person's belief in his or her ability to use the internet to accomplish certain goals [58]. Within the context of education, Papastergiou et al. [59] explain internet self-efficacy as students' individual beliefs regarding their ability to use the internet and multimedia blogging. ICT self-efficacy is a representation of one's awareness of competency, capabilities, skills, and abilities to use ICTs [60]. Students' self-efficacy in ICT influences their confidence, motivation, participation, achievement, and engagement in ICT-related tasks and activities [61].

ICT self-efficacy varies by gender, and in fact, some studies have concluded that female students relatively perceive lower self-efficacy in the usage of computers and related ICT applications than their male counterparts [24, 62, 63]. However, Vekiri and Chronaki [26] concluded from a study of students in Greece that, though males had higher levels of positive self-efficacy about computers compared to females, male students were more likely to engage in hardware computer activities. Other studies have reported an insignificant gender difference in ICT self-efficacy among university students [21]. Finally, according to Durndell et al. [64], the ICT self-efficacy of males and females is usually similar for fundamental skills, but males exhibit a significant confidence advantage over females for advanced file and software skills.

2.3. Gender and ICT Attitude. According to Papanastasiou and Zembylas [65], an attitude is a favorable or unfavorable response to things, people, places, events, or ideas. McGuire [66] proposes three components of attitude: knowledge about an object (cognition), a tendency to act with or react to an object (behavior), and a feeling about an object (affect). Accordingly, in this study, "ICT attitude" is defined as students' cognition, affect, and behavior toward the use of ICT applications. ICT attitude is important given its influence on the extent of commitment toward ICT usage [67]. Generally, university students' attitudes toward ICT have changed over the last 20 years [68] because of the evolution of digital technology and how it affects learning and interaction among students [69]. Several attributes, including gender, relate to students' ICT attitudes, albeit with mixed conclusions. For example, various studies comparing gender and attitudes toward ICT usage have reported insignificant differences [21, 23]. On the other hand, some studies have reported that males exhibit more positive ICT attitudes than females [24, 25, 29], whereas a minority of studies have found males to exhibit a more negative attitude toward ICT usage than females [46, 70].

2.4. Gender and ICT Anxiety. Anxiety is an unpleasant, observable, and emotional reaction such as tension, perception, and sadness triggered by stress-creating conditions [71]. ICT anxiety is the fear of interacting with ICT and showing overall negative attitudes toward ICT, which leads to a deterioration of tasks and their accomplishment (Shashaani, 1993). Generally, ICT anxiety inhibits the future use of ICT [72]. Furthermore, Celik and Yesilyurt [73] averred that students with high computer anxiety rarely use computers. Results of other studies have concluded that high levels of ICT anxiety inhibit the adoption of new technology and limit improvement in computer literacy [58]. ICT anxiety negatively affects perceptions of usefulness, ease of use, and intention to use and acquire skills and knowledge in computers [74].

Scholars have investigated the relationship between ICT anxiety and gender. However, conclusions on the subject to date have largely remained inconsistent. Many studies have reported that females, compared to males, exhibit higher levels of ICT anxiety [27, 70, 75]. In a study involving 150 university students in Romania, females showed greater levels of computer anxiety than males [27]. Other studies have reported that the levels of computer anxiety are the same for males and females [21, 23]. In a study of 251 undergraduate students selected from the University of Technology in South Africa, Schlebusch [24] concluded that computer anxiety did not vary between male and female students.

Based on the foregoing literature and the purpose of the study, four research questions were formulated:

RQ1: Is there any statistically significant difference between male and female university students in terms of ICT usage?

RQ2: Is there any difference in ICT self-efficacy between male and female university students?

RQ3: Does attitude toward ICT vary between male and female university students?

RQ4: Is there any difference in ICT anxiety between male and female university students?

Table 1: ICT access and gender.

Variable	Response	Gender		Total	χ^2
		Male	Female	Frequency (%)	
Age of first contact with computers	≤10 years	56.7	43.3	67 (16.4)	3, $n = 408$, $\chi^2 = 0.193$, $p > 0.05$
	10–15 years	59.4	40.6	160 (39.3)	
	16–20 years	57.6	42.4	125 (30.6)	
	≥20 years	57.1	42.9	56 (13.7)	
Computer ownership when in SHS	Yes	46.0	35.9	170 (41.6)	1, $n = 407$, $\chi^2 = 4.159$, $p < 0.05$
	No	54.0	64.1	237 (57.9)	
Do you currently own a computer	Yes	74.3	66.9	291 (71.1)	1, $n = 409$, $\chi^2 = 2.66$, $p > 0.05$
	No	25.7	33.1	118 (28.9)	

3. Materials and Methods

3.1. Participants. Given the aim of the study, that is, examining gender differences in ICT attitudes and anxiety, quantitative research methodology and a cross-sectional design were adopted. Relative to a qualitative methodology, the use of a quantitative methodology enabled the collection of quantifiable data to statistically explore gender differences in ICT attitudes and anxiety. The study is based on primary data conveniently collected from 409 students studying engineering (mechanical, electrical, civil, building technology, and agricultural engineering) and hospitality management programs in a 3-year Higher National Diploma (HND) awarding technical university located in Ho, the Volta Region of Ghana. The student population of the university was approximately 4,500, with males constituting 68% and mostly studying engineering programs while females predominantly studied hospitality, fashion, and secretarial courses. Engineering and hospitality students were conveniently chosen to investigate the ICT-gender divide because of their gender-segregated characteristics. Largely, an overwhelming majority of the students in the university study at the HND level, while top-up Bachelor of Technology (2-year study leading to the award of a bachelor's degree) students were less than 4% of the student population. As of the period of data collection, there were 851 engineering and 568 hospitality students at the university. With a population of 1,419, the sample size for the study was estimated to be 303 based on a 5% margin of error and a 95% confidence level. However, to take care of misplacements and nonresponses, 420 paper-and-pencil questionnaires were proportionally distributed across the two programs. All the questionnaires were retrieved, but 408 were analyzed while 12 were discarded due to incompleteness.

The survey was conducted in August 2018 in classrooms after the authors sought permission from their colleagues. Questionnaires were handed over to students who were available and willing to participate in the survey after they were assured of their voluntary participation and confidentiality. Students dropped the completed questionnaires in boxes placed at the entrance of classrooms. More than half of the respondents were male (57.9%), with about 6 out of 10 of the respondents aged 25 years or below and largely unmarried (93.9%). Second- and third-year students constituted 37.8% and 35.4% of the sample, respectively, while first-year students were in the minority (26.8%). In the sample, 89.7% were HND students. Of the 408 respondents, more than half (57.8%) were engineering students and mostly male (94.9%), while the 172 (42.2%) hospitality students in the sample were more likely to be female (93.0%) (χ^2 (1, $N = 408$) = 315.5, $p < 0.001$).

3.2. Measures. ICT usage—participants' ICT usage was measured using 16 items developed by Noiwan et al. [76] on a 5-point Likert scale ranging from "*1 = never*" to "*5 = every day*" with a Cronbach's α of 0.84. Attitude toward ICT—Ertmer et al. [77] 18 items, comprising both positive and negative attitudes, were used to measure attitudes toward ICT on a 5-point Likert scale ranging from "*1 = strongly disagree*" to "5 = *strongly agree*." The Cronbach α's for the negative and positive subscales are 0.71 and 0.83, respectively. ICT anxiety—Ertmer et al. [77] eight items were adopted in rating ICT anxiety level on a 5-point Likert scale ranging from "*1 = strongly disagree*" to "5 = *strongly agree*." The estimated Cronbach α was 0.77. ICT self-efficacy—19 items adapted from Khan et al. [78] and Ertmer et al. [77] were used to assess computer self-efficacy in word processing and social media on a 5-point Likert scale type ranging from "*1 = not confident*" to "*5 = very confident*" with a Cronbach α value of 0.96.

3.3. Analysis. Respondents' demographic characteristics were summarized using frequencies and percentages. Mean and standard deviation were used to explore respondents' usage of ICT and self-efficacy. Mann–Whitney *U* test was used to examine gender differences in ICT attitude, self-efficacy, anxiety, and general ICT and social media usage. Mann–Whitney *U* test, a nonparametric statistical technique, was used because of the non-normality distribution of the data following Shapiro–Wilk tests. Nonparametric statistical tools are recommended when data is not normally distributed. In addition, ordered logistic regression was conducted to assess the influence of gender and other demographic variables on ICT usage, attitude, anxiety, and self-efficacy.

4. Results

4.1. Computer Contact and Ownership. Of the 408 research participants, nearly 40% first encountered computers when they were aged between 10 and 15 years. However, the age of exposure to computers did not vary by gender (Table 1).

Table 2: ICT usage.

ICT applications	Median score	Gender		Z	Significant
		Male	Female		
General (computer) usage					
General ICT use	3.51	3.73	3.16	−2.98	$p<0.05$
ICT use for coursework	3.41	3.61	3.13	−2.97	$p<0.05$
Email	2.98	3.40	2.57	−4.83	$p<0.001$
Computer games	2.96	3.23	2.61	−4.01	$p<0.001$
Web browsing	3.47	3.88	2.92	−4.69	$p<0.001$
Total	3.30	3.53	2.99	−4.69	$p<0.001$
General software application					
Word processing, for example, MS Word	2.96	3.21	2.54	−3.29	$p<0.001$
Presentation, for example, MS PowerPoint	2.59	2.75	2.40	−3.12	$p<0.05$
Spreadsheet, for example, MS Excel	2.47	2.62	2.27	−3.28	$p<0.001$
DBMS, for example, MS Access	1.69	1.73	1.63	−1.20	$p>0.05$
Total	2.58	2.68	2.44	−2.83	$p<0.05$
Specialized software application					
Statistical package, for example, SPSS	1.66	1.71	1.59	−1.31	$p>0.05$
Social network					
WhatsApp	4.74	4.72	4.78	−1.05	$p>0.05$
Facebook	4.09	4.06	4.14	−0.447	$p>0.05$
YouTube	3.65	3.63	3.67	−0.075	$p>0.05$
Twitter	2.97	2.95	3.00	−0.121	$p>0.05$
Instagram	2.94	2.79	3.21	−1.26	$p>0.05$
Snapchat	2.62	2.40	3.02	−2.22	$p<0.05$
Total social network	3.47	3.43	3.53	−0.799	$p>0.05$

Note: Scale: 1 = never, 2 = less than once a month, 3 = at least once a month, 4 = at least once a week, 5 = every day.

About 7 out of 10 respondents indicated ownership of computers, but again, ownership did not differ between genders. Regarding ownership of computers while in senior high school (SHS), less than half (41.6%) of the students owned computers at that level of their education. Nevertheless, male students were more likely than their female counterparts to indicate ownership of computers at their secondary school level. A χ^2 test of independence result reveals a significant difference between gender and computer ownership in SHS ($\chi^2 = 4.159$, $p<0.050$) (Table 1).

4.2. Student ICT Usage. The results of respondents' usage of various ICT applications categorized into general computer usage, general software application, and social network sites are set out in Table 2. Across the various categories of ICT usage, WhatsApp ($MD = 4.74$), Facebook ($MD = 4.09$), and YouTube ($MD = 3.65$) were the most used ICT applications. MS PowerPoint ($MD = 2.59$), Spreadsheet, for example, MS Excel ($MD = 2.47$), database management system (DBMS), for example, MS Access ($MD = 1.69$) and Statistical Packages, for example, SPSS ($MD = 1.66$) were the least used ICT applications. Overall, the students indicated frequent use of social network applications, followed by general computer usage.

4.3. Gender and ICT Usage. The results of Mann–Whitney U tests that sought to explore gender differences in ICT usage are set out in Table 2. A significant gender difference was found for general computer use ($p<0.001$) and specific dimensions including general ICT use ($p<0.05$), ICT use for coursework ($p<0.05$), email ($p<0.01$), computer games ($p<0.01$), and web browsing ($p<0.001$). There was a significant difference between gender and general software applications ($p>0.05$) and their dimensions, except for DBMSs. However, significant differences were not found for gender and social networks ($p>0.05$). Overall, male students were more likely than their female counterparts to indicate frequent use of various ICT applications ($p<0.05$). Specifically, male students were more likely than females to use eight ICT applications: Microsoft Word, PowerPoint, Excel, Email, Computer games, ICT for coursework, among others, whereas female students were significantly more likely to Snapchat compared to male students. Interestingly, the frequency of using social media applications such as Twitter, Instagram, YouTube, and WhatsApp did not vary by gender. In the case of advanced ICT applications, that is, SPSS and MS Access, usage was undifferentiated between genders.

4.4. Student ICT Self-Efficacy. Table 3 depicts students' self-assessments of their capabilities in ICT-related tasks. Students were more confident in "playing a movie on a computer ($MD = 3.98$)," "finding a saved text on a computer ($MD = 3.75$)," and "changing the background of the desktop ($MD = 3.75$)." However, students lowly rated their capabilities in "using a search feature in a word processing programs ($MD = 3.23$)," including "Microsoft Office Publisher ($MD = 3.07$)," "Microsoft Access ($MD = 2.07$)," and "Windows installation ($MD = 2.81$)."

Table 3: ICT self-efficacy.

ICT applications	Total median	Gender		Z	p-Value
		Male	Female		
General (computer) usage					
Play a movie on a computer	3.98	4.12	3.60	−2.57	$p<0.05$
Find a saved text on a computer	3.75	4.03	3.31	−3.06	$p<0.05$
Changing desktop background	3.75	4.10	3.26	−4.00	$p<0.001$
Save a text on a computer	3.68	4.01	3.23	−2.83	$p<0.05$
Windows installation	2.81	3.23	2.20	−4.74	$p<0.001$
General software application					
Making corrections while word processing	3.55	3.86	3.11	−3.18	$p<0.001$
Microsoft PowerPoint	3.56	3.78	3.18	−2.89	$p<0.05$
Saving the document written while word processing	3.51	3.79	3.06	−3.66	$p<0.001$
Renaming a word processing file to make a backup copy	3.58	4.01	3.00	−4.32	$p<0.001$
Formatting text, for example, bold, underlining while word processing	3.53	3.80	3.10	−3.06	$p<0.05$
Using a word processing program to write a letter or report	3.40	3.67	3.06	−2.12	$p<0.05$
Accessing previous files with a word processing program	3.33	3.58	2.95	−3.30	$p<0.001$
Using spell checker while word processing	3.34	3.51	3.08	−2.26	$p<0.05$
Printing out files written while word processing	3.34	3.62	2.86	−3.28	$p<0.001$
Microsoft word processing	3.35	3.55	3.00	−2.66	$p<0.05$
Microsoft Excel	3.35	3.55	2.98	−3.28	$p<0.001$
Using the searching feature in a word processing	3.23	3.54	2.75	−3.70	$p<0.001$
Microsoft Office publisher	3.07	3.27	2.71	−3.01	$p<0.05$
Microsoft Access	3.07	3.41	2.39	−4.97	$p<0.001$
Total self-efficacy		3.455	2.96	−4.76	$p<0.001$

Note: Scale: 1 = not confident, 2 = low level of confidence, 3 = confident, 4 = quite confident, 5 = very confident.

Table 4: Negative attitudes toward ICT.

Attitudes toward ICT	Gender		Z	p-Value
	Male	Female		
I don't have any use for ICT on a daily basis	1.58	1.54	−0.38	$p>0.05$
I don't think ICT will be useful to me in my profession	1.73	1.99	−2.53	$p<0.05$
I am not the type to do well in ICT	1.99	2.33	−2.25	$p<0.05$
Anything that ICT can be used for I can do just as well in some other way	3.24	3.19	−0.12	$p>0.05$
The thought of using ICT frightens me	1.95	2.33	−2.08	$p<0.05$
ICT is confusing to me	1.97	2.50	−2.77	$p<0.05$
I am anxious about ICT because I don't know what to do if something goes wrong	2.37	2.79	−2.86	$p<0.05$
I don't see how I can use ICT to learn new skills	2.07	2.69	−3.09	$p<0.05$
Knowing how to use ICT will not be helpful in my future work	1.96	2.49	−2.59	$p<0.05$
Overall negative attitude	2.40	2.65	−2.96	$p<0.05$

Note: Scale: 1 = Strongly disagree, 2 = Slightly disagree, 3 = Undecided, 4 = Slightly agree, 5 = Strongly agree.

4.5. Gender and ICT Self-Efficacy. Table 3 demonstrates the results of Mann–Whitney U tests conducted to find out whether ICT self-efficacy varies by gender. A significant gender difference was found for all dimensions of general computer and software applications ($p<0.05$). Male university students were more confident about their ICT capabilities compared to their female colleagues ($p<0.01$). Of all the 19 ICT applications (general computer usage and software applications) examined, male students self-rated themselves higher than female students did.

4.6. Gender and Negative Attitude toward ICT. As shown in Table 4, overall, female students exhibited higher levels of negativity toward ICT compared to their male counterparts. The Mann–Whitney U test results revealed differences between gender and overall negative attitude toward ICT ($p<0.05$) in all dimensions except "I don't have any use for ICT on a daily basis." Female students more than male students indicated higher levels of negative attitudes toward ICT in respect of 7 out of the 10 unfavorable statements about ICT measured in the study.

Table 5: Positive attitude toward ICT.

Attitude toward ICT	Gender		Z	p-Value
	Male	Female		
Using ICT to communicate with others over a computer network can help me to be more effective in my future job	3.89	2.75	−3.78	$p<0.001$
I am confident about my ability to do well in a task that requires me to use ICT	3.48	3.12	−1.94	$p<0.050$
I feel at ease learning about ICT	3.58	3.41	−1.24	$p>0.05$
With the use of ICT, I can create materials to enhance my performance in my future job	3.88	3.00	−2.74	$p<0.05$
If I can use word processing software, I will be more productive	3.57	3.34	−1.63	$p>0.05$
I could use ICT to access many types of information sources for my work	3.96	3.77	−0.82	$p>0.05$
I do not feel threatened by the impact of ICT	3.63	3.33	−1.03	$p>0.05$
ICT can be used to assist me in organizing my future work	3.80	3.69	−0.97	$p>0.05$
I feel comfortable about my ability to work with ICT	3.68	3.54	−1.20	$p>0.05$
Total positive attitude	3.49	3.20	−2.48	$p<0.05$

Note: Scale: 1 = strongly disagree, 2 = slightly disagree, 3 = undecided, 4 = slightly agree, 5 = strongly agree.

Table 6: Anxiety toward ICT.

Anxiety toward ICT	Gender		Z	p-Value
	Male	Female		
I feel insecure about my ability to interpret a computer printout	2.17	2.44	−1.39	$p>0.05$
I do not think I will be able to learn a computer programming language	2.38	2.57	−0.896	$p>0.05$
I am afraid that if I begin to use computers, I will become dependent upon them and lose some of my reasoning skills	2.42	2.97	−2.87	$p<0.05$
I dislike working with machines that are smarter than I am	2.03	2.59	−3.11	$p<0.05$
I feel fearful about using computers	1.96	2.51	−2.76	$p<0.05$
It scares me to think that I could use the computer to destroy a large amount of information by hitting the wrong key	2.39	2.63	−1.54	$p>0.05$
I hesitate to use a computer for fear of making mistakes that I cannot correct	2.19	2.49	−1.90	$p>0.05$
I have avoided computers because they are unfamiliar and somewhat intimidating to me	1.88	2.39	−2.92	$p<0.05$
Total anxiety	2.47	2.76	−3.48	$p<0.001$

Note: Scale: 1 = strongly disagree, 2 = slightly disagree, 3 = undecided, 4 = slightly agree, 5 = strongly agree.

4.7. Gender and Positive Attitude toward ICT. Table 5 shows Mann–Whitney U test results exploring the relationship between gender and positive attitudes toward ICT. As observed in the table, a significant difference was found for overall positive attitude and gender ($p<0.05$) as male students exhibited a more positive attitude toward ICT compared to their female colleagues. Three out of nine items, including "With the use of ICT, I can create materials to enhance my performance on my future job ($p>0.05$)" and "I am confident about my ability to do well in a task that requires me to use ICT ($p<0.001$)," were significant. Additionally, males reported a positive attitude toward the use of ICT to communicate with others over a computer, to create materials to enhance job performance and to have confidence in their ability to do well in a task that requires them to use ICT.

4.8. Gender and Anxiety toward ICT. The results for gender differences in ICT anxiety are set out in Table 6. As demonstrated in the table, only five out of eight items that measured ICT anxiety indicated a statistically significant difference between male and female students. Female students showed a lot of anxiety toward ICT usage, including the fear of making mistakes that cannot be corrected, the perception that the machines are smarter than them, and the fact that they are unfamiliar and somewhat intimidating to them. Overall, ICT anxiety differed between female and male students in the sample.

4.9. Determinants of ICT Attitude, Usage, Self-Efficacy, and Anxiety. The results of ordered logistic regression examining the influence of gender and other demographic variables on ICT attitude, usage, self-efficacy, and anxiety are set out in Table 7. Based on the results, female students were about 1.71 times more likely to indicate negative attitudes toward ICT compared to male students. In respect of the level of study, the odds of being negative about ICT were about 2.03 times higher for HND students compared to top-up B.Tech students. In the case of access to computers, students who did not own computers were more likely to report a negative ICT attitude than students who indicated computer ownership. In respect of positive attitudes toward ICT, the odds of female students being positive about ICT were 0.58 times lower relative to male students. Concerning the level of

Table 7: Results of ordered logistic regression ($N = 408$).

	Negative ICT attitude			Positive ICT attitude			ICT self-efficacy			ICT anxiety			General ICT usage			Software applications		
Variable	β	SE	Exp. (β)	β	SE	Exp. (β)	β	SE	Exp. (β)	β	SE	Exp. (β)	β	SE	Exp. (β)	β	SE	Exp. (β)
Gender																		
Female = 0	0.55	0.20	1.73*	−0.54	0.20	0.58*	−0.89	0.20	0.40**	0.82	0.20	2.28**	−0.95	0.20	0.38**	−0.54	0.20	0.58*
Male = 1 (ref)																		
Age																		
≤25	−0.37	0.21	0.68	0.83	0.21	2.29**	0.61	0.21	1.84*	−0.18	0.21	0.83	0.42	0.20	1.52*	0.29	0.21	0.47*
≥26 (ref)																		
Level																		
HND	0.70	0.36	2.03*	−1.76	0.37	0.17**	−1.04	0.35	0.35*	1.29	0.37	3.64*	−1.52	0.36	0.21**	−0.73	0.33	1.34*
B.Tech (ref)																		
Age @ computer contact																		
≤15	0.19	0.20	1.21	0.42	0.20	1.53*	0.28	0.20	1.33	0.45	0.20	1.57*	0.60	0.20	1.83*	−0.01	0.20	0.98
≥16																		
Computer ownership																		
No	0.53	0.21	1.70*	−0.40	0.21	0.66*	−0.71	0.21	0.49*	0.27	0.21	1.31	−0.49	0.21	0.61*	−0.57	0.21	0.56*
Yes (ref)																		
Diagnostics																		
Goodness of fit (Pearson)	χ^2 (df) = 70.20 (63); $p = 0.24$			χ^2 (df) = 58.2 (63); $p = 0.64$			χ^2 (df) = 47.3 (63); $p = 0.93$			χ^2 (df) = 75.3 (63); $p = 0.13$			χ^2 (df) = 76.2 (63); $p = 0.12$			χ^2 (df) = 56.25 (47); $p = 0.16$		
−2 Log likelihood	χ^2 (df) = 185.4 (7); $p < 0.005$			χ^2 (df) = 178.6 (7); $p < 0.001$			χ^2 (df) = 172.8 (7); $p < 0.001$			χ^2 (df) = 180.8 (7); $p < 0.001$			χ^2 (df) = 195.8 (7); $p < 0.001$			χ^2 (df) = 167.0 (5); $p < 0.001$		
Parallel lines test	0.44			0.52			0.68			0.09			0.45			0.72		
Pseudo R^2 (Cox and Snell)	0.04			0.13			0.13			0.07			0.14			0.04		

Note: $N = 408$, *$p < 0.05$; **$p < 0.01$.

study, HND students were about 1.76 times less positive about ICT relative to B.Tech students.

Based on the logistic regression results, students who reported contact with computers at age 15 or less were about 1.53 times more likely to be positive about ICT compared to their colleagues who were exposed to computers at age 16 or more. Students who intimated they did not own computers were about 0.66 times less positive about computers compared to those who did. Regarding ICT self-efficacy, female students were about 0.36 times less confident about their ICT capabilities relative to male students. Younger students considered themselves 1.84 times more efficacious in ICT than students aged 26 or more. However, HND students were 0.35 times less efficacious in ICT compared to B.Tech students. However, the age of exposure to computers was unrelated to perceptions of computer self-efficacy. Regarding ownership of computers, students who reported ownership of computers considered themselves 0.49 times more efficacious than students who did not own computers. Regarding ICT anxiety, the odds were 2.29 times higher for female students than male students. The age of students was unrelated to ICT anxiety. However, HND students were 3.64 times more likely than B.Tech students to report higher levels of computer anxiety. Quite surprisingly, students exposed to computers at age 15 or less were 1.57 times more ICT anxious than students exposed to computers at age 16 or more. In respect of general ICT usage, the odds of using ICT for general purposes were 0.38 times lower for female students compared to males. Students aged 26 or less were 1.52 times more likely to use ICT frequently than students aged 26 or more. In respect of the level of study, HND students reported 0.21 times less usage of ICT compared to B.Tech students. Students exposed to computers at age 15 or less indicated 1.83 times more usage of ICT compared to those who were exposed to computers at age 16 or more. Finally, students who did not own computers reported 0.61 times less usage of ICT compared to students who did. In the case of software applications, female students were 0.58 times less likely to use software applications compared to males. Younger students were 0.47 times more likely to use software applications compared to students aged 26 or older. HND students were 1.34 times less likely to report frequent use of software applications compared to B.Tech students. The odds of students who did not own computers using software applications were 0.56 times lower than students who owned computers.

5. Discussion

This study sought to examine the effect of gender and other demographic variables on ICT usage, attitude, self-efficacy, and anxiety among a sample of students drawn from a technical university in Ghana. The results of the study provide evidence to show that gender differences still exist concerning ICT usage, attitude, self-efficacy, and anxiety. Female students were more negative and less positive toward ICT relative to their male peers. These results confirm the assertion that females demonstrate a negative attitude toward ICT [70], while males exhibit a more positive disposition toward ICT (Cai et al., 2017) [24, 25]. In addition, based on the ordered logistic regression, it was further revealed that general usage of ICT and its related software applications was comparatively lower among female students than males. This result mirrors those of previous studies that examined ICT usage and gender differences among university students [25, 47]. In respect of perceived ICT self-efficacy, the results of the study corroborate the conclusions of earlier studies [24, 62, 63] that males rate themselves as more adept at using ICT tools than females. Largely, the findings of the study seem to suggest that female students were more likely to report higher levels of ICT anxiety compared to male university students. This finding is consistent with earlier works [27, 70, 75] reported in the literature.

Based on the foregoing, the result of the study does seem to suggest that gender differences still exist in behaviors toward ICT in the higher education setup in some countries, despite efforts to close the digital gender gap. The observed gender differences in ICT attitudes, usage, confidence, and anxiety in the study can be explained by gender role socialization and cultural norms that are endemic in patriarchal societies around the world. Ghana's society is highly patriarchal [79] and characterized by high levels of masculinity [80]. Within this sociocultural setting, females are systematically socialized to perceive and believe that anything relating to electrical gadgets belongs to the domain of males. This schema of socialization has tended to render females more cautious, less confident, and uncertain, as well as avoidant of ICT. Admittedly, while the influence of gender role socialization on female behavior toward ICT is gradually waning, its fundamental influence remains, thereby emphasizing the observed gender differences between male and female students in their behavior toward ICT in the study.

Beyond gender, other demographic factors were related to ICT attitude, self-efficacy, usage, and anxiety. For instance, students' study level affects all the six dependent variables examined in the study. Bachelor of Technology students were more positive and less negative toward ICT relative to HND students. These results imply that as students advance in their studies, they become more positive and less negative about ICT. Based on the ordered logistic regression results, as students advance in their studies, they are likely to report higher levels of ICT self-efficacy and use, as well as reduced ICT anxiety. Ownership of a computer enhances the perceived efficacy, attitude, and general usage of ICT, leading to a reduced negative attitude toward ICT. The younger the student, the more positive the attitude toward ICT and the higher the frequency of ICT usage and self-efficacy.

Consistent with the results of previous studies [34, 35], computer ownership among the research participants was high. This result is not surprising since ICT applications have become central to the teaching and learning processes in almost all universities [81] and students need computers for both educational and social purposes. Students are required to take computer literacy courses in their respective programs of study, and accessibility to computers has

become necessary if students are to fulfill course requirements that entail the submission of typed assignments. The increasing computer ownership among university students as observed in the study might be due to the increasing availability of affordable refurbished laptops and desktop computers in developing countries [82], which is fueling the increasing personal computer penetration among university students.

A disturbing result of the study is the students' relatively limited use of Microsoft applications, including MS Word, PowerPoint, Access, and Excel. Similar results have been reported in earlier studies conducted among university students in Ghana [39, 83], where the use of ICT for social or leisure-related activities was considerably higher than for academic work. The meaning of this finding is that, though students might own personal computers, they are likely to be spending less time on MS Word, PowerPoint, Access, and Excel, which are the productive computer applications required for the world of work. Less usage of productive softwares implies that students will lack the requisite ICT skills required by employers. It is therefore not surprising that the research participants reported lower levels of confidence in the use of Microsoft applications.

6. Practical Implications

The results of the study offer valuable information to both university administration and parties involved in developing ICT policies and guidelines for bridging the gender gap in higher education institutions. The study also provides useful information about ICT gender differences. Male students were found to be more self-efficacious compared to females in the Microsoft Office Suite. Consequently, efforts must be made to bridge the gap between the sexes. To combat sociocultural norms that discriminate against girls and their use of digital technology, it is crucial to provide them with the skills they need to participate in and prosper in the digital transformation. There are various methods to achieve this. Among them are launching awareness-raising and educational programs that show how girls are ideal candidates and skilled enough to handle ICT-related tasks. To aid girls in learning challenging ICT skills, pedagogical techniques that encourage mixed-gender teamwork should be encouraged and supported, especially in ICT-related courses. Newmarch et al. [84] suggested that for most female students, "pressing a button successfully is enough." Dorman [85] believes that girls must be taught how to function creatively in a technological world. Consequently, the structure of pedagogy should enable the use of a variety of ICT tools to meet the needs of the learner. Furthermore, using successful role models as mentors can help inspire female students while dispelling inaccurate stereotypes of ICT as a male-dominated field. The study revealed that students have a lower propensity toward the use of Microsoft Office applications, including MS Word, PowerPoint, Access, and Excel. This finding suggests students are likely to be unprepared for productive computer application use at workplaces. Consequently, classroom-based session programs that focus on enhancing students' efficacy in Microsoft applications should be encouraged. For example, teachers must be encouraged to adopt an engaging approach to teaching Microsoft applications in the classroom through lesson presentation, creation, storage, and providing useful feedback on lessons. Additionally, teachers should be encouraged to design study programs that enhance and promote increased private use and application of Microsoft applications.

7. Conclusion

This study investigated gender differences in ICT usage, attitude, self-efficacy, and anxiety among university students in Ghana. Male students compared to female students reported frequent usage of ICT applications, low anxiety, exhibited a more positive attitude toward the use of ICT, and highly rated their ICT capabilities higher than female students. Furthermore, the research participants self-reported high computer ownership and indicated frequent but gender-invariant use of social media applications.

Data Availability

Data supporting this research article are available from the corresponding author or first author on reasonable request.

Additional Points

Limitations of the Study. The application of the results of this study should take into consideration the following limitations. First, the study relied only on quantitative data, which is criticized for oversimplifying issues due to its reliance on numbers. Thus, the plausible explanations and subjective issues behind the figures have not been captured. Also, the use of the nonprobability convenience sampling technique raises questions about the representativeness of the data. Finally, the choice of a single technical university limits the generalizability of the findings to all technical universities.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This study was funded by the authors without external funding support.

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