Gender and ICT affability amongst Students in Selected Public Secondary schools of Nyamagana District in Tanzania

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Abstract
The current study investigated whether gender has an influence on the use of ICTs among secondary school students in Nyamagana district, located in the Mwanza region of Tanzania. The specific objectives of this study were (i) to establish if there are gender differences in ICT sociability among secondary school students and (ii) to determine the extent to which students use ICT to facilitate learning activities. The research employed a random sampling technique to select four schools, and a total of 121 students participated in the study. Questionnaires were administered to collect information from students, and t-tests and descriptive statistical analyses were conducted using the SPSS software version 20.0. The results revealed that male students showed a higher level of interest in using ICT devices compared to their female counterparts. This was evident from the calculated t-values and p-values, which exceeded the critical values of 1.96 and 0.05, respectively (i.e., $t > 1.96$, $p > 0.05$). With regard to accessibility, the study observed that male students had better access compared to female students. The results revealed that 56.1% of female students reported having no access to ICT facilities, while male students accounted for 43.9%. The results show that female students faced challenges in terms of accessibility and usability of ICT compared to their male peers during their learning activities. In light of these findings, the study suggests the formulation of policies that promote equal utilisation of ICT devices for students of all genders.

Keywords: *Gender, ICT affability, ICT, public secondary schools*

Introduction and Background

The significance of information and communication technologies (ICTs) within the educational landscape is increasingly undeniable. Teachers and students rely on technology for various educational activities. For students, ICT enhances learning by promoting higher-order thinking skills, facilitating subject learning, and encouraging peer collaboration

(Sánchez & Alemán, 2011). It allows students to access information efficiently, engage in self-directed learning, and develop critical thinking skills through interactive and creative learning environments (Sánchez & Alemán, 2011). Moreover, ICT in education supports personalised learning, motivates students, and improves engagement and knowledge retention, ultimately leading to better academic performance and preparation for the demands of 21st-century society and workforce (Aqsha & Pei, 2009; Sánchez & Alemán, 2011). Although ICTs offer various advantages, there exists a gender disparity in their utilisation among students, where female students encounter barriers in accessing and utilising ICT resources compared to male students (Drabowicz, 2014; Siddiq & Scherer, 2019). These disparities can lead to unequal opportunities for skill development, academic achievement, and future career prospects. For instance, a study by the Organisation for Economic Co-operation and Development (OECD) in 2018 indicated that men are four times more likely than women to be ICT specialists. Furthermore, statistics indicate that, on average, only 0.5% of girls aspire to become ICT professionals, in contrast to 5% of boys at age 15 (OECD, 2018).

Tanzania is not exempted from gender disparities in ICTs. According to the data provided by the Tanzania Communication Regulatory Authority (TCRA), internet users in Tanzania were 31.1 million, of whom only 18% were women (TCRA, 2023). This shows that women still lag behind in the access and use of ICT facilities. In trying to resolve this disparity, a number of initiatives have been undertaken by both the government and other stakeholders outside of the government. For instance, the government has taken steps to incorporate ICTs as a compulsory subject at the primary school level, whereas the same practice is not consistently applied in secondary schools. Despite the effort, ICT is still taught in relatively few urban public and private primary schools, widening the problem of inequalities (Mpapalika, 2023). In 2023, the government of Tanzania developed an ICT policy emphasising gender equality in ICT (URT, 2023), recognising basic ICT skills as important qualifications in public service recruitment (URT, 2022).

Despite government efforts, gender disparities in ICT among students remain a concern. Globally, there have been several studies carried out to investigate aspects related to ICT within the teaching and learning process. Studies such as those conducted by Albugami and Ahmed (2015) and Delen and Bulut (2011) focused on how ICT enhance performance, collaboration, learning experiences, and outcomes for teachers and

students. Other studies focused on aspects such as ICT device ownership and access (Zhang, 2014; Delen & Bulut, 2011) and gender disparities in digital competencies (Maon et al., 2021; Ünal et al., 2022). Others focused on opportunities created by ICT-enabled environments for reducing gender gaps (Aqsha & Pei, 2009; Rizal et al., 2019; Liang, 2022) and gender and ICT literacy among students (Apriani et al., 2022).

Within Tanzania, the existing studies focused on ICT integration in classrooms (Kihoa et al., 2016), the impact of digitalisation on teaching and education (Manyengo, 2021), enhancing education quality through ICT resources (Peter, 2022), and investigating ICT competencies in teacher education (Lubuva et al., 2022). However, a noticeable gap exists in studies concerning gender and ICT affability among secondary school students, warranting further exploration. This research addressed this gap in the context of selected public secondary schools in Nyamagana District, Tanzania, guided by the following specific objectives:

i) To establish gender differences in ICT sociability among secondary school students
ii) To determine the extent to which students use ICTs to facilitate learning activities

Gender and Technology Theory

The study follows the gender and technology framework, linking gender (socially constructed roles) and technology (practical application). According to Nagoshi et al. (2012), this theoretical framework seeks to explore how gender shapes the design, utilisation, and impact of technology while also examining how technology, in turn, influences and reinforces gender norms and inequalities.

In the context of gender and technology theory, gender influences how people use and access technology (Kube et al., 2022). Scholars have observed historically that there are gender differences in access to technology, which means that some groups face barriers to using it and become digitally excluded (Wolfram & Kienesberger, 2023; Grint & Gill, 1995). As such, this theory offers an understanding of how gender influences secondary schools' affection for ICT and the use of digital technology. This idea clarifies the relationship between gender and technology, which is helpful in this study. It also offers a framework for comprehending how gender affects secondary school pupils' ICT affability. Additionally, the gender and technology framework can help determine students' capacity to access and utilise ICT within their

learning activities. Understanding how gender and technology interact can help to enhance the use of technology in classrooms in a more inclusive and equitable way.

Gender and ICT Affability in Education

Gender and ICT affability refers to the degree of accessibility with which individuals of different genders can access and engage with information and communication technology (ICT) resources and opportunities (Saadu et al., 2022). The relationship between gender and ICT affability has far-reaching implications for social and economic development, as technology plays an increasingly central role in education provision. ICTs are used as resources for teaching and learning at different levels of education. However, a study conducted in India highlighted that women's engagement in digital technology and the Internet remains lower than men's, even when women are educated (Anjana, 2023). Similarly, Islam and Manchanda (2022) analysed 735 responses from Indian men and women between the ages of 18 and 25. The survey found that women, particularly in rural areas, are less likely than men to exclusively own smartphones. On the other hand, Anjana's survey revealed that gender disparity in digital affability is more acute in rural areas (Anjana, 2023).
Contrary to this, Islam and Manchanda (2022) observed that women have access to household phones, which are normally shared with other family members. Therefore, it is incontestable to accept that the gender gap in digital technology is undeniably a complicated and multifaceted subject. Access to ICT resources, including computers, internet connectivity, and digital devices, is an important aspect of ICT affability (Tondeur et al., 2016).

Numerous studies such as those by Qazi, Hasan, Abayomi-Alli, Hardaker, Scherer, Sarker, and Maitama (2022), have shown gender disparities, with males typically having better access to ICT infrastructure than females. Factors such as economic resources, household dynamics, and cultural norms contribute to these differences, resulting in a digital divide that can perpetuate gender inequalities in technology use (Daffé & Diallo, 2020). Likewise, Tondeur et al. (2016) examined the relationship between gender, computer access, attitudes, and uses in both learning and everyday activities for university students in Flanders (Belgium). The findings revealed that women generally have a less positive attitude towards computers; however, their attitude towards computers for educational purposes does not differ from that of men (Tondeur et al., 2016).

Research shows that male students often have better access to computers, internet connectivity, and digital devices compared to their female counterparts (Daffé & Diallo, 2020; Tam et al., 2020; Bolaji, 2022; Qazi et al., 2022). However, there are factors that determine gender disparities in ICT accessibility, such as the availability of basic infrastructure and the cost of access to technology (Daffé & Diallo, 2020). Therefore, limited access to ICT infrastructure can create a digital gap, further exacerbating gender inequalities in technology usage and skill development (Bolaji, 2022; Qazi et al., 2022; Islam & Manchanda, 2022; (Mhlanga et al., 2022).

Accessibility and Usability of ICTs in Education

Information and communication technology (ICT) holds a crucial position in contemporary life, drawing considerable attention across various sectors, including education (Qazi et al., 2022). Nonetheless, its application reveals notable individual differences in usage patterns and relevant skills (Heiman et al., 2017). Over the last decade, incorporating ICT into education has emerged as a highly transformative process, shaping academic standards (Nketiah-Amponsah et al., 2017). As articulated by Heiman et al. (2017), the impact of ICT on education is closely linked to students' access to and utilisation of digital devices. Despite the widespread integration of ICT in educational institutions, several studies (Maon et al., 2021; Liang, 2022) feature a gender disparity in both its usage and skill development.

Heiman et al. (2017) compared Canadian and Israeli students' familiarity with and access to ICT in traditional post-secondary education. Israeli students reported higher ICT usage and better accessibility than Canadian students, with factors such as individual competencies, gender, and technology affordability influencing usage. Similar findings were supported by other researchers like Nketiah-Amponsah et al. (2017) and Mhlanga, Denhere, and Moloi (2022), emphasising the role of ICT competence, gender, and economic feasibility in students' access to and utilisation of ICTs.

Qazi et al. (2022) reviewed 42 empirical publications and conference proceedings from 2006 to 2020 to probe into this issue. Their small-scale meta-analysis aimed to quantify potential gender differences in ICT use and skills. Using a random-effects model, the analysis revealed a small yet statistically insignificant effect size favouring boys ($g = 0.17$, 95% CI

[−0.01, 0.36]). Furthermore, their research indicated no association between gender-based differences in skills and the utilisation of ICT for educational purposes (Qazi et al., 2022).

In the Netherlands, Volman et al. (2005) examined the utilisation of various ICT applications in education across seven schools. The findings indicated relatively minor gender-based disparities in primary education. However, a notable difference emerged in secondary education, with girls appearing to be less enthusiastic about ICT compared to boys. The study also observed differences in how girls and boys engaged with ICT tasks, influenced by their previous experiences and exposure to ICT resources.

The impact of ICT on education is significant, enhancing the teaching and learning process by improving the accessibility and usability of ICT tools (Mhlanga et al., 2022; Onwuagboke, 2023). Additionally, ICT can aid in identifying individual students' learning needs, thus promoting equal educational opportunities (Mhlanga et al., 2022). The National Policy on Education (Mhlanga et al., 2022) reinforced the importance of integrating ICT to enhance teaching and learning, thereby improving educational outcomes. Notably, the extent of technology integration into classrooms can profoundly impact a country's educational quality.

Based on the above discussion, prioritising students' interests, especially improving the usability and accessibility of ICT for female students, is important. This involves implementing strategies to bridge the gender gap in ICT usage, ensuring equal opportunities for engagement and benefit from digital resources. Initiatives such as targeted training programs, user-friendly interfaces, and fostering an inclusive learning environment are crucial for achieving this goal.

Methodology

Participants

The participants in this study were form four secondary school students who were involved voluntarily. They were selected based on two specific criteria: firstly, because they were most likely to have greater exposure to ICT; and second, they were under pressure to prepare for their final national exams, which probably increased their interest in using ICT to access extra learning resources. The sample size comprised of 121 students, chosen randomly. Gender distribution within the sample was also considered, with 50 males and 71 females. The number of females participating in this study was higher than males, occupying 58.7% of the

whole sample population, while only 41.3% were males, as shown in Table 1.

Table 7: Socio-demographic Characteristics

Variable	Frequency	Percentage (%)
Male	50	41.3
Female	71	58.7
Total	121	100

The participants in this study were selected using a random sampling technique. For a purpose of gathering the best information, the sample was chosen from form four classes due to their familiarity and experience in the use of ICT.

Instruments

The questionnaires utilised in this study comprised 15 items designed to explore the relationship between gender and ICT affability among secondary school students. These items were divided into two distinct groups. The first group consisted of 10 items aimed at assessing the usability of ICT tools in facilitating learning activities. Participants rated their agreement with statements on a five-point Likert scale ranging from "Very Large extent" to "Very little Extent." Conversely, the second group comprised five (5) items focused on identifying the challenges students encounter regarding access to and usage of ICTs for learning activities, eliciting simple YES/NO responses. All items were adapted from the Gender and Information and Communication Technologies survey toolkit developed by FHI 360, ensuring their relevance and reliability for the study's objectives.

Procedures

The procedure for data collection involved distributing questionnaires to the participants. The questionnaires, designed according to FHI 360's survey toolkit, were distributed to Form Four secondary school students to collect data. Each participant was allotted a time frame of 30 minutes to respond to the questions. Following the completion of the allotted time, the questionnaires were collected promptly. Upon collection, the received questionnaires were thoroughly sorted and organised to ensure systematic handling of the data. Subsequently, a coding system was implemented to categorise and label the responses effectively, facilitating the process of data analysis. The coded data were then entered into SPSS version 20 for further analysis and interpretation. This careful procedure was

implemented to ensure accuracy and reliability in capturing the data necessary for the study's objectives.

Data Analysis

Before processing the results, the normality test was applied. The purpose of conducting a normality test was to assess whether the data follows a normal distribution. Descriptive and inferential tests were applied. The first objective aimed to establish gender differences in ICT sociability among female and male students. To achieve this, an independent sample t-test was employed. This statistical analysis was conducted to determine whether significant differences existed between male and female students in terms of their sociability to ICT resources. For the second objective, which focused on identifying and analysing the challenges faced by students in accessing and utilising ICTs, descriptive statistics were employed. This involved examining the frequency and percentage of challenges encountered by students. Through frequency counts and percentages, the study aimed to illuminate the common obstacles hindering students' access to and use of ICTs. This approach provided valuable insights into the prevalent challenges faced by students, thereby informing potential interventions to address these issues effectively.

Variables

In this study, two key variables were identified: gender, which served as the independent variable, and ICT sociability, which was designated as the dependent variable. Gender, as the independent variable, refers to the characteristics being observed to determine its effect on the dependent variable, ICT sociability. This variable represents the participants' gender identities, typically categorised as male or female and serves as the primary factor under investigation to understand its influence on ICT sociability. On the other hand, ICT sociability, the dependent variable, is the outcome or response variable measured in the study.

Findings and Discussion

Normality Testing

The purpose of conducting a normality test was to assess whether the data followed a normal distribution. Fig.1 below shows that the data were normally distributed, thus warranting parametric tests, which in this case were independent sample t-tests.

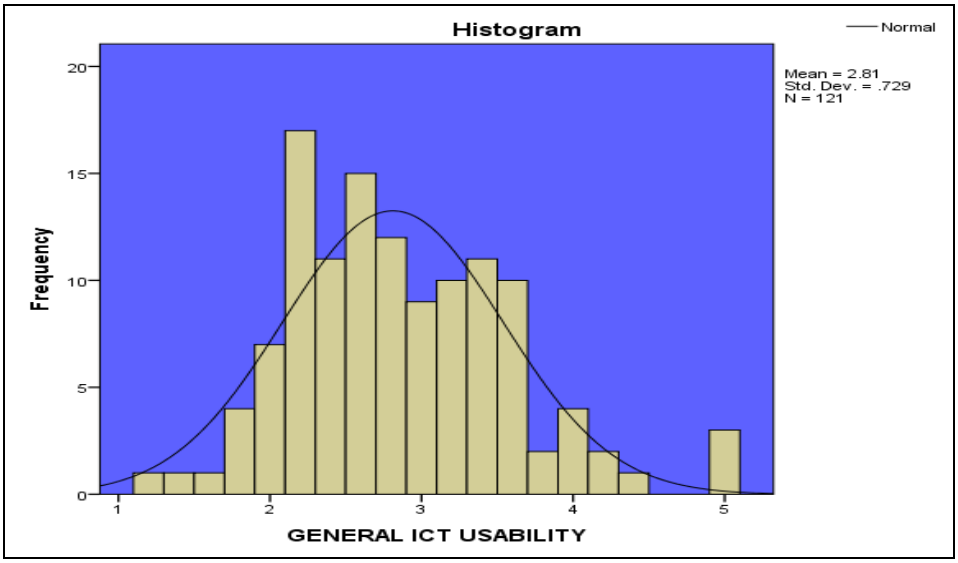

Figure 1: Normality Testing

Gender Differences in ICTs Sociability among Secondary School Students

The study set out to explore gender differences in ICT sociability among secondary school students. Following a descriptive analysis, the results are presented in Table 2 below.

Table 8: Descriptive statistics of Gender ICTs Sociability

	Gender	N	Mean	SD
Gender ICTs Sociability	Male	50	2.94	.685
	Female	71	2.72	.749

A comparison of the mean reveals that male students reported a higher score (Mean = 2.94) on ICT sociability compared to female students (Mean = 2.72). The results imply differences in ICT sociability among male and female students. That means males appear to have more interest in ICTs, access, and usability for learning purposes.

Independent Samples Test of Gender and ICT Sociability

In order to make statistical inferences, an independent sample t-test was used to measure statistical differences between the means of two groups (male and female groups) on ICT sociability. Following the analysis, the results are displayed in Table 3 below.

Table 9: Independent Samples Test of Gender and ICT Sociability

	Male		Female				
	M	SD	M	SD	t	df	P
Gender ICTs Sociability	2.94	.685	2.72	.749	1.702	120	0.091

Table 3 depicts an independent-sample t-test among genders on ICT sociability. The findings indicate a significant gender difference in ICT sociability between male and female students. This was evident from the calculated t-values and p-values (t= 1.702, p= 0.091), both of which exceeded the critical values of 1.96 and 0.05, respectively (i.e., $t > 1.96$, $p > 0.05$). Male students appeared more interested (M=2.94, SD= .685) than females (M=2.72, SD= .749) in ICT sociability.

These findings indicate that Female students lag behind in using ICT for sociability. These findings concur with that of Heiman et al. (2017), Mhlanga et al. (2022), and Volman et al. (2005). According to Volman et al. (2005), engagement in ICTs differs in terms of gender, as both males and females tackle technology with diverse interests and intentions. On the contrary, Mhlanga et al. (2022) support the current findings that the high scores of males in ICT sociability against female students is an indicator that females are less exposed to technology and lag behind in ICT affability. Heiman et al. (2017) and Mhlanga et.al. (2022), on the other hand, emphasise that ICT sociability is determined by factors such as levels of competence, gender and affordability of technological resources. Furthermore, Anjana (2023) insists that engagement with technology depends on socio-cultural norms and accessibility of technological devices. Therefore, the gender gap in association with technology is created by the unequal distribution of resources and cultural practices. Additionally, it is important to note that the accessibility and usability of ICTs may be influenced by individual differences depending on their exposure and experiences (Jadhav et al., 2022; Ulioyo, 2022; Qazi et al., 2022).

Students' Accessibility and Usability of ICTs to Facilitate Learning Activities

The second objective was to determine the extent to which students access and use ICTs to facilitate learning activities. The results, following descriptive statistics, are portrayed in Table 4 below.

Table 10: Students' Accessibility and Usability of ICTs

ICT Access and Use Statements	Gender		Total
	Male	Female	
My parents have no funds to buy ICT gadget	39	43	82
My friends do not like to share with me ICT gadgets	14	13	27
I don't find the necessity of using ICT gadgets	6	11	17
My parent restricts me to use ICT gadgets	25	32	57
I do not have time to use ICT gadgets	10	21	31
Total Responses	**94(43.9%)**	**120(56.1%)**	**214(100%)**

The results indicate a significant difference in students' access and usability to ICT facilities. The findings reveal that 43.1% of male students lack access and usability to ICT, and a higher percentage, 56.1%, of female students, also face challenges in accessing and usability of ICTs. The findings show that females lag behind in accessibility and usability of ICTs compared to male counterparts in their learning activities. Lack of accessibility and usability results from parental restrictions to abandon technology, particularly for girls, who also seem to have limited time to access and use technology. These findings are similar to Daffé and Diallo (2020), Bolaji, (2022), and Qazi, et.al. (2022) as they highlighted factors such as economic constraints and cultural beliefs hinder females from accessing and using of ICTs effectively.

The results from the current study indicate the need for females to be exposed to technology for competence development to bridge the gender gap in the use of ICT. Mhlanga et.al. (2022) reiterate the significance of recognizing and addressing these gender differences in access and use of technology to promote inclusivity in education.

Contribution of the Study and Limitations

The present research explores the theoretical and practical aspects of gender differences in the usability and accessibility of information and communication technology (ICT) in educational settings. By addressing these aspects, the research highlights the potential disparities, challenges, and opportunities of improving ICT affability among students participating in educational activities. If these disparities are not addressed, as stressed in Mhlanga, Denhere and Moloi (2022), the gap between male and female students may amplify. This indicates how important it is to address gender disparities in ICT use in order to promote inclusivity and fair educational opportunities. This study contributes to the body of knowledge by illuminating the multifaceted interaction between gender dynamics and ICT education. Significantly, it informs

targeted interventions and policies aimed at promoting gender equity and inclusivity in ICT education, ultimately contributing to the empowerment and success of female students in the digital age.

The adoption of gender and technology theory provides a framework for understanding the multifaceted relationship between gender dynamics and ICT education. This theoretical lens reveals how societal norms, power dynamics, and cultural expectations influence students' experiences with ICT. The study highlights the specific challenges encountered by female students, who not only face barriers to accessing ICT resources but also struggle to manipulate them effectively for learning purposes. Consequently, targeted interventions, such as the development and implementation of gender-sensitive policies and programmes, are imperative. These interventions aim to enhance both access to ICT infrastructure and the digital literacy skills of female students. Moreover, addressing gender-specific challenges and inequalities in ICT utilisation is crucial for promoting inclusivity and equitable opportunities in education.

While this study offers valuable insights into gender differences in ICT accessibility and usability within educational contexts, several limitations warrant acknowledgement. Firstly, the research focuses solely on selected public secondary schools in Nyamagana District, Tanzania, which may limit the generalizability of the findings to other educational settings or regions. Additionally, the study primarily relies on data from students using the questionnaire survey, which may introduce response bias. Moreover, the examination of gender disparities in ICT affability does not encompass intersecting factors such as socioeconomic status, cultural background, or geographical location, which could further expose the complexities of ICT engagement.

Based on the identified limitations, future research could explore comparative studies to investigate the influence of varying contexts on gender disparities in ICT accessibility and usability. For example, expanding beyond Nyamagana District to include a broader range of educational settings, such as urban and rural areas, and different regions within Tanzania, would enrich our understanding. Moreover, employing a mixed-methods approach that combines quantitative data from surveys with qualitative insights from interviews or observational tools can offer a more comprehensive understanding of gender dynamics in ICT education.

Conclusion and Recommendations

The study's findings emphasise the fundamental role of gender in shaping the sociability and engagement of secondary school students with information and communication technologies (ICT). Evident within the data are pronounced gender disparities in the accessibility and usability of ICT resources, outlining a significant divide in how male and female students interact with technology. These distinctions extend beyond accessibility to socialisation and the educational utilisation of ICT. While technology presents various opportunities for educational enrichment, its integration necessitates a vigilant approach to ensure alignment with pedagogical objectives. In light of these findings, the study recommends that educational institutions, policymakers, stakeholders, and communities should collectively address gender discrepancies in ICT engagement. Through collective efforts, inclusive practices can be fostered, thereby paving the way for equitable opportunities for all students within the educational setting.

Furthermore, the study advocates for educational institutions and policymakers to prioritise developing and implementing gender-sensitive policies. These policies should be formed to promote equitable access to ICT resources and opportunities among all students. Specifically, interventions are needed to address the specific needs and challenges encountered by female students in their access to and utilisation of ICTs for learning activities. By acknowledging and addressing these gender-specific barriers, educational institutions can create an inclusive learning environment where all students, regardless of gender, have equal opportunities to harness the potential of ICTs for academic growth and success.

In conclusion, this study advocates for the gender disparities present in ICT accessibility and usability within educational settings. It emphasises the significance of addressing these differences to avoid worsening existing issues and widening the gap between male and female students. To promote inclusivity and equitable opportunities in education, prioritising initiatives to overcome gender-specific barriers to ICT access and utilisation is essential. The recommendations outlined in this study offer a pathway for educational institutions, policymakers, and stakeholders to collectively address these challenges and create a more inclusive and equitable learning environment for all students.

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