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Unraveling the attributions of digital literacy skills and knowledge gap in Ghana's higher education: Undergraduate students voices in a phenomenological study

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Abstract

Any undergraduate student lacking the knowledge and skills for digital technology will find it challenging to succeed academically and thrive in the 21st -century higher education setting. This study employed a novel conceptual framework built from ecological theory to investigate the attributions of the knowledge and skill gap in digital literacy among Ghanaian undergraduate students. A phenomenological qualitative design with a purposive sampling technique was implemented to collect data from 16 undergraduates in a large public university in Ghana in a four-months period. The findings show several factors responsible for students' digital literacy knowledge and skills gap. Undergraduates have ascribed these reasons to various macro and micro factors. The students attributed their skills gap to personal, parental, institutional, and government factors, pointing to the need for concerted action from national and international policymakers and educators alike. This paper argues that university lecturers, administrators, the Ministry of Education, and policymakers in Ghana should collaboratively redesign comprehensive, persuasive, and integrated digital literacy approaches to benefit undergraduate students at all levels.

Keywords Digital literacy skills · Digital literacy knowledge · Higher education · Undergraduates · Ghana

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1 Introduction

One of the primary objectives of the United Nations' Sustainable Development Goal 4 is to significantly increase the proportion of the global population with at least a basic level of digital literacy competency. Due to this, digital literacy is a crucial tracking indicator for Sustainable Development Goal (SDG) goal 4.4, which focuses on "relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship" among youth and adults. Digital literacy, as defined by UNESCO (2019), is the capacity to use digital devices and networked technologies to safely and effectively access, manage, comprehend, integrate, communicate, evaluate, and generate information for participation in economic and social life. It encompasses skills such as media literacy, information literacy, computer literacy, and Information and Communication Technology (ICT) literacy (UNESCO, 2019).

Higher education teachers and administrators see the value of promoting digital literacy among their students (Gonzales, 2010; Hannon, 2009). Although this skill set has become increasingly important for achieving SDG goal 4, there is a significant knowledge gap about the level of digital literacy among youth and adults worldwide due to countries needing to collect more data on digital literacy skills and knowledge (Laanpere, 2019). For many, lacking ICT tools and knowledge places them at a disadvantage in this twenty-first-century teaching and learning environment. Individuals lack digital literacy knowledge because studies claim that people take the ability to use computers and the Internet to perform basic tasks for granted (Orrick, 2011; Seale, 2009; van Dijk, 2006). Although universities remain the critical engines of social development (Adeoye & Adeoye, 2017), this serves as a challenge for universities to include digital literacy in the education system (Techataweewan & Prasertsin, 2018).

Therefore, there is a need to investigate the attributions of the digital literacy skills gap among undergraduates, and the research suggests that this is particularly true in nations in the global south. For instance, Ukwoma et al. (2016) surveyed students at the University of Nigeria, Nsukka, to assess their digital-technology proficiency. Most students believe that being adept at using technology directly affects their academic performance. In 2013, Parvathamma and Danappa Pattar (2013) surveyed students at a management institution in the Davanagere region of Karnataka to assess their familiarity with digital media. Although just 2.96 per cent of respondents were aware of IndiaStat, 22.96 per cent had heard of online databases and were acquainted with the name "Capitaline." Web portals were the most commonly utilised information source, whereas open-access journals and institutional repositories were the least used. There have been several attempts to improve citizens' digital literacy in many countries in the Global North with varying degrees of success (Murray & Pérez, 2014). Countries like Japan and South Korea (OECD, 2013) and the United Kingdom (European Commission, 2013) have implemented similar policies. However, such efforts could be much better for nations in the Global South, especially those in resource-constrained Africa. The absence of comprehensive efforts to improve digital literacy skills has resulted in the digital literacy skills gap existing among undergraduate students, especially in countries in the global south, hence the need to explore

the sources of these gaps and how these gaps can be curtailed from undergraduate students' perspectives in Ghana.

1.1 Ghana's context and undergraduate digital literacy gap

Like most countries in the Global South, Ghana has low levels of digital literacy among the marginalised global Community, contributing to the digital literacy gap (Hadjerrouit, 2010; Junge & Hadjivassiliou, 2007). This is despite numerous supranational programs or services in the realm of digital literacy skills, which have prioritised global research endeavours (UNESCO, 2019). Ghana's universities seem sluggish to appreciate the importance of technologically proficient graduates to the modern economy. Many instructors and potential employers may take proficiency with computers and the Internet for granted, yet this may put students at a severe disadvantage (Katz & Macklin, 2007). Students in today's world are constantly surrounded by and exposed to digital media. However, the extent to which higher education students can effectively use information Technology to solve ordinary business and practical problems is often exaggerated (Murray & Pérez, 2014).

Furthermore, numerous educators and employers think college and university curricula must adequately prepare students for careers requiring digital literacy (Duggan, 2013). Adeoye and Adeoye (2017) note that individuals find adapting to the digital environment increasingly challenging because of the explosion of information sources and technological advancements. A lack of knowledge and skills in operating and utilising ICTs is a significant barrier to enhancing digital literacy. Concerns regarding the digital literacy gap have been raised because of this disparity since it threatens to exacerbate existing inequalities in information access (Seale, 2009; van Dijk, 2006). As a result, it is possible that undergraduates in Ghana who have yet to become acquainted with technology will have a more challenging time succeeding academically and have fewer job options.

Undergraduates in Ghanaian higher education need more attention to close the digital literacy gap between themselves and their Global North colleagues or risk falling farther behind. Because of this, narrowing the digital literacy gap, especially for individuals in Ghana who lack digital literacy (Hohlfeld et al.,2008; Seale, 2009), is considered critically dependent on students' actual experiences with digital literacy knowledge, skills and education. Several recent studies (Techataweewan & Prasertsin, 2018; Payal et al., 2018) have highlighted the need for more research on students' digital literacy. This void in the literature must be filled with more than case studies or quantitative approaches to optimal practice alone (November & Day, 2012). Examining the problem from the perspective of students' lived experiences is crucial, as it allows for a critical analysis of the fundamental presuppositions that drive this area of study. Based on this discussion, this study sets out to investigate the following questions:

i. How do undergraduates in Ghana explain the factors behind their lack of digital proficiency and knowledge?
ii. How do undergraduates in Ghana explain how their digital literacy skills can be improved?

1.2 Conceptual framework

This study builds on Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1998; Bronfenbrenner, 2005) to contribute a novel conceptual framework for studying the perspectives of undergraduate students on their digital literacy knowledge and skills. The ecological theory is one of the most widely recognised theories explaining how social settings affect human development. According to Bronfenbrenner's theory, the most significant difficulty facing the educational system is comprehending the intricate impacts, interactions, and relationships between a learner and several other systems that are connected to them from an ecological system theory or systems change perspective (Bronfenbrenner, 1998; Bronfenbrenner, 2005). The Bronfenbrenner systems model, which evaluates the reciprocal and dynamic interactions between the student and the environment, is a suitable paradigm for studying the attributions of undergraduate students' digital literacy skills gap (Renn & Arnold, 2003).

Bronfenbrenner (1994) intended to establish a theory of human development that would consider the effects of all systems that impact the individual's lived experiences, no matter how remote the influence. Many of these notions are now widespread in social work practice (for example, micro-, meso-, and macro systems); their empirical base is sometimes overlooked (Crawford, 2020). Against this backdrop, we consider it worthwhile to build upon this theory by contributing a novel conceptual framework to study student's digital literacy.

In this study, as seen in the conceptual framework, we examine each student individually to determine how their surroundings may contribute to their lack of digital literacy. The study considers the different facets of Bronfenbrenner's Ecological theory to determine the most fundamental causes of students' digital literacy gaps by focusing on how undergraduate immediate relationships, overarching values, and beliefs contribute to the individual student digital literacy skills gap (microsystem). It again finds out the relationship and role between an undergraduate student's immediate relationships (family) and other external factors in their digital literacy skills gap and how external institutions and procedures (exosystem) affect students' digital literacy abilities and knowledge gaps and ways such factors could help resolve it. Finally, it explores how decisions made by the Government affect students' knowledge and gaps in digital literacy (the macro system). This has been discussed within the conceptual framework shown in Fig. 1.

The conceptual framework considers students' interactions with their immediate social and environmental circumstances, the reciprocal relationship between them and their surroundings, and how these interactions have influenced their digital skills and knowledge levels. The model demonstrates that student personal variables, parental/community support, school/institutional factors, and governmental factors may directly or indirectly impact undergraduate students' digital literacy skills and knowledge. The conceptual framework also demonstrates that students' reluctance to study ICT, their access to functional, technologically advanced and helpful gadgets, and their access to the Internet may all have a direct or indirect impact on the consequences of their digital literacy. Government resources and regulations may directly impact students' digital literacy (intervening processes). The current study proposed

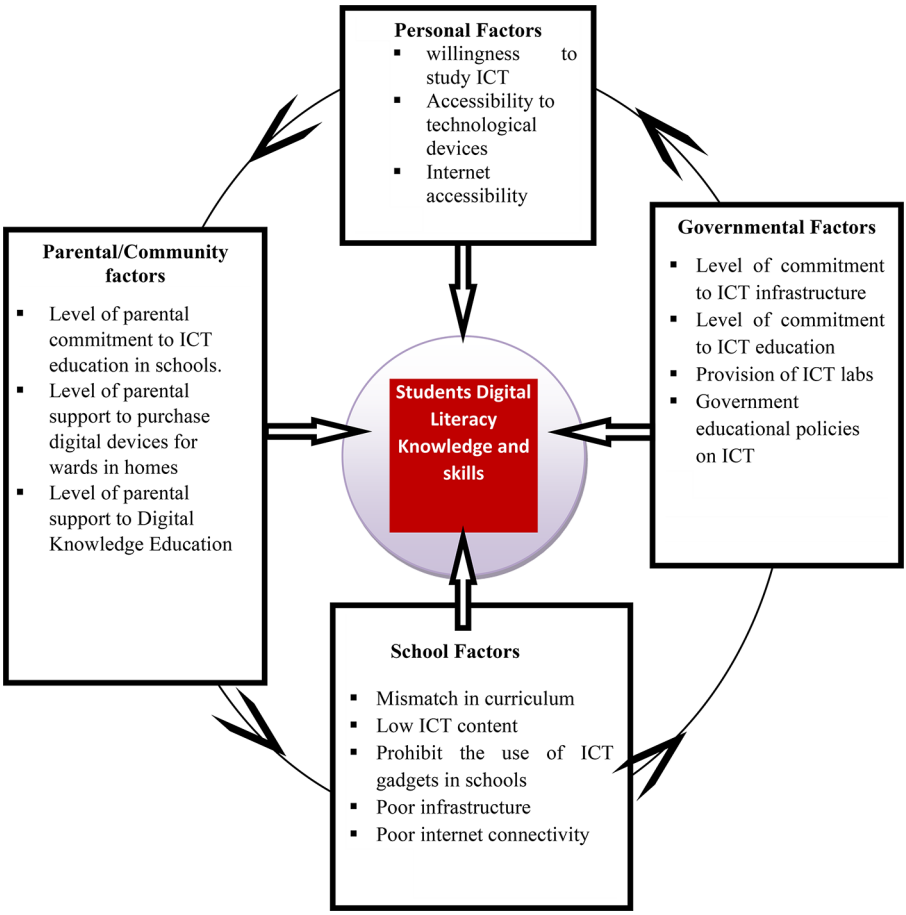

Fig. 1 Study's conceptual framework explaining the sources of digital literacy gap among students

that school and governmental elements determine student's digital literacy knowledge and that the availability or non-availability of resources or the level of Government, parents, and community engagement and commitment to ICT education, including infrastructure provisions and other ICT policies may influence students' digital skills either positively or negatively.

2 Methodological approach

A phenomenological qualitative design was used in this study. The data was collected through semi-structured interviews. We describe the methodology used for this study in detail in this section.

2.1 Participants recruitment

This study was part of a more extensive doctoral study that sought to document the thoughts and sentiments about the digital literacy gap among undergraduate students in Ghana. Sixteen university students, through purposive sampling, were selected to participate in the study. All participants were undergraduates who admitted to facing challenges in applying technology in their studies. These students were those who accepted to seek academic support from friends instead of relying on the Internet for information and academic support due to their low knowledge of using technological gadgets to seek academic support. Participants were purposively chosen from all levels, from first year to final year from the University of Education Winneba in Ghana's Central Region. The University of Education, Winneba, is one of Ghana's largest public universities, enrolling 67,000 students (GTEC, 2021). The University of Education, Winneba, is one of the top choices for students who do not want to join Ghana's lengthy line of unemployed students. This is because the university's mandate is to prepare students as teachers for all levels of education in Ghana. This motive attracts most undergraduate students from all backgrounds to the university, including those who need to be digitally proficient.

2.1.1 Demographic characteristics of participants

Ten of the participants were male, and six of the participants were female, out of a total of 16. The ages of the individuals varied from 19 to 30 years old. Four (4) students served as the class representatives for each level, which included first, second, third, and fourth years. Fourteen (14) of the sixteen (16) participants used mobile devices to study. One of the participants used a laptop, while one did not use any technological device to study. Eleven (11) participants owned operational digital devices (mobile phones) that could establish an internet connection. Even though they had mobile phones, two participants could not use them since their devices were broken. One of the participants lacked any kind of technological equipment. The participant's demographic information has been broken down and shown in Table 1.

2.2 Data collection and analysis

The main topics around which questions were asked using a Focus Group Discussion (FGD) and semi-structured interview guide included how undergraduates in Ghana explain the factors behind their lack of digital proficiency. Participants were asked to explain the personal, institutional, governmental, and other environmental factors causing their digital literacy knowledge and skills gap. They were further asked to discuss ways to improve their digital literacy skills. Applying the FGD and the semi-structured interview provided direct human interaction with participants, enabling the researchers to probe and clarify questions misunderstood by the participants (Tichapondwa, 2013). The interview for each FGD session lasted two hours, while the semi-structured interviews with each participant lasted an hour. The interviews ended when saturation was reached. The interview with the participants lasted for four months.

Table 1 Demographic information of participants

Pseudonyms	Gender	Age	Education Level	Digital device Use	Status of Device
1st (Ben)	Male	21	First-Year	Mobile phone	Functional
2nd (Aya)	Male	23	First-Year	Mobile phone	Functional
3rd (Serdof)	Female	20	First-Year	Mobile phone	Faulty
4th (Nat)	Male	22	First-Year	Mobile phone	Functional
5th (Rukia)	Female	19	Second-Year	Mobile phone	Functional
6th (Rhozie)	Female	21	Second-Year	Mobile phone	Not working
7th (Abena)	Female	20	Second-Year	Mobile phone	Internet unfriendly
8th (Rockson)	Male	21	Second-Year	Mobile phone	Functional
9th (Benny)	Female	23	Third-Year	Laptop	Faulty
10th (Ange)	Female	21	Third-Year	Mobile phone	Functional
11th (Faizal)	Male	24	Third-Year	Mobile phone	Functional
12th (Musah)	Male	30	Third-Year	Non-available	Non-available
13th (Ansong)	Male	26	Fourth-Year	Mobile phone	Functional
14th (Dickson)	Male	28	Fourth-Year	Mobile phone	Functional
15th (Kofi)	Male	27	Fourth-Year	Mobile phone	Functional
16th (Kwame)	Male	25	Fourth-Year	Mobile phone	Functional

A pilot study and a peer review assessment of the interview questions were made to prevent researchers' bias and ensure the interview guide measured what it was intended to uncover. Moreover, the peer-debriefing approach was employed to establish credibility and trustworthiness. In addition, four criteria were used to measure the trustworthiness and triangulation of qualitative data, as proposed by Lincoln and Guba (2010) and Denscombe (2007): credibility, dependability, transferability, and confidentiality.

In achieving Trustworthiness prolonged involvement, according to Lincoln and Guba (1985) is another technique for ensuring credible interpretation of findings. The first author who assisted in the data collection immersed himself in the lives of the participants. This enabled the first author to better grasp the study's environment and cultural surroundings while boosting participants' trust and lowering the risk of data misrepresentation resulting from the data collection in the field (Onwuegbuzie & Leech, 2007).

In addition, the study process was described in detail so that others may replicate it and determine the level of dependability. Dependability was created in this study by establishing acceptable inquiry decisions. This includes an assessment of interviewers' bias while also avoiding providing incorrect data due to participant weariness because of lengthy interview sessions.

After coding and transcribing the audiotapes, field notes, interview questions, consent forms and all other necessary material and documentation relating to the research were returned to the study participants to validate the responses for ensuring confirmability. After making all of the changes, the researchers returned the transcribed data to the participants (Shenton, 2004) for them to verify the conclusions drawn. After that, the researchers used the final transcribed data from the participants as an accurate record of what they said. The outcomes of this helped to ensure that the codes, statements, and interpretations accurately represented participants' expressed views, which significantly increased the consistency, transferability, reliability, and

dependability of the data given in this study. This also helped minimise transcription errors during data collection and verify the information's accuracy.

We accept the limitations of qualitative research, particularly regarding sample size and generalisation difficulties. In this regard, the limited number of study participants might be considered a limitation. Nevertheless, the study's methodological strength comes from the in-depth quality of the findings, which may provide significant answers and insights that quantitative measurements cannot provide. Future studies may consider including a larger number of participants, and a quantitative study with participants from all the public universities in Ghana can provide further insights.

The Lingnan University Ethical Review Committee in Hong Kong granted ethical approval. Participants' consent to participate in the research project was requested and acquired, and participants' data confidentiality and anonymity were stressed.

The next step was transcribing the data. To ensure accuracy, each written transcript was read several times while listening to the corresponding audio tape. After transcribing the data and becoming familiar with the written text, the transcriptions were read to some participants to see if the information they represented was accurate. Afterwards, the process of interpreting the data began, which involved coding and categorising data by identifying themes and developing general conclusions (Denscombe, 2007). The researchers compiled data into sections of repetitive ideas across different transcripts of different participants, and the information was then grouped with specific codes. The next stage consisted of interpretative coding, where the researchers went beyond describing relevant features of participants' accounts and focused more on their interpretation of their meanings. Similar codes, as propounded by Cresswell (2010) and King and Horrocks (2010), were aggregated together to form a significant idea in accordance with the research questions. The researchers moved backward and forth through the above stages with all transcripts. The researchers grouped descriptive codes that share a common meaning. Each task was revisited as the codes, themes, and categories became more refined.

Lastly, the researchers developed concepts and arrived at some generalised statements and conclusions based on the relationships, patterns, and themes identified in the data. As echoed by Denscombe (2007), these concepts provided the basis for the researchers' data analysis and are the foundation for any generalised conclusions. The final step involved the researchers communicating the findings. By this, the researchers reviewed the analysis in light of other explanations of similar data and compared the new generalised conclusions with alternative theories in the literature.

3 Findings

The following are six (6) specific ways that demonstrate students' perceptions of the various sources or attributions of students' knowledge and ability gaps in digital literacy, as well as how such skills could be improved in Ghana's higher education: (1) Digital literacy knowledge and skills gap attributed to Higher Education institution failure to intensify ICT programmes and internet access. (2) Digital literacy knowledge and skills gap attributed to weak foundations in ICT at elementary and

Senior High School levels. (3) Digital literacy knowledge and skills gap attributed to the low parental commitment to ICT education. (4) Digital literacy knowledge and skills gap attributed to the Government's low commitment towards providing ICT infrastructure among institutions of higher learning. (5) Strengthening Government and institutional commitment to ICT to improve students' digital literacy skills, and (6) Mass parental and community engagement. The themes that emerged are summarised in Table 2 and discussed as follows:

3.1 Higher education institutions fail to offer more ICT content and intensified internet access (institutional factor)

All the participants agreed that the need for Ghanaian universities to make more progress in advancing ICT programs contributed to the students' low levels of digital literacy. Some students noted that ICT is only offered once out of the four years and eight semesters they spend in school. In the students' opinion, the course material does not adequately prepare them for the in-depth knowledge and abilities needed in the digital age. Ben explained how the university's insufficient ICT content or programs have affected his knowledge and skills in digital literacy as follows:

> "Many University students lack basic ICT skills, but the institution is unconcerned about this. We are only taught ICT for one semester throughout the eight semesters" (Ben, a first-year male student).

It was also evident from participant narratives that universities need more commitment to increase opportunities for internet access on diverse campuses due to institutional shortcomings. Since the university had made no effort to enhance internet connectivity on campus, all sixteen participants stressed how much of their money

Table 2 Identifiable themes and corresponding research questions

Research Question/Objective	Themes identified	Factor/Level	Number of f participants
How do undergraduates explain the factors behind their lack of digital proficiency and knowledge?	• Higher Education institutions fail to offer more ICT content and intensified internet access. • The weak ICT foundations at the elementary and secondary school levels • Low Parental commitment to ICT Education (Parental factor) • The low commitment of the Government toward ICT infrastructural facilities at the Community and university	• Institutional factor • Institutional factor • Parental factor • Governmental factor	• All 16 undergraduate student participants • Thirteen out of 16 undergraduate student participants • All 16 undergraduate student participants • All 16 undergraduate student participants
How do undergraduates explain the way their digital literacy skills can be improved?	• Strengthening Government and institutional commitment to ICT • Parental and Community Engagement (Parental and Community factors)	• Government and institutional factors • Parental and Community factors	• Nine undergraduate student participants • Ten undergraduate student participants

went into paying for internet bandwidth to browse the web. They felt they could not get the education they needed in the digital realm due to a lack of access to the Internet at school and an inability to afford supplemental data plans. What follows is an extract from Rukia in which she discusses the effect the university's decision not to give Wi-Fi to more students has had on her digital literacy:

> "The institution faces a problem with Wi-Fi coverage. Enrollment is growing, and every student is assigned to the limited Wi-Fi, causing network issues. I do not have enough money to buy data internet data either; all these are part of the reasons why I am not digitally proficient" (Rukia, a second-year female student).

All participants agreed that unreliable and poor internet access at their schools had a negative impact on their ability to think digitally. This problem focuses on students' difficulty due to colleges and universities failing to implement adequate measures to improve internet access for students in educational institutions. They spoke about how universities cannot provide them with greater internet access due to resource and funding constraints. By sharing their own experiences, they drove that point home. For instance, a female student named Benny shared the following:

> "The environment in which we find ourselves in Ghana has also limited our Internet use. We know poor network connectivity is a national issue, but it is even worse on campus. I have not been able to use Wi-Fi since my first year. So, it is not always our fault. In this situation, how can I improve my digital skills?" (Benny, a third-year female student).

The above findings have revealed how students think Ghana's higher education institutions have not done much to advance ICT programs and offer more ICT content and internet accessibility. It has been shown that the inability to intensify ICT content and support ICT learning has affected students' digital literacy skills.

3.2 The weak ICT foundations at the elementary and secondary school levels (institutional factor)

The participants also pointed out that students do not have a solid grounding in ICT until they reach high school. Thirteen of sixteen interviewees said they lacked the foundations for using digital technologies. The sixteen students who participated in the study all felt that the information and communication technology (ICT) instruction they received in high school was insufficient to prepare them for success in university. Ten participants believed that despite having poor foundations, not much was done to assist them in developing their abilities at the tertiary level because it was usually assumed that they had mastered the basics in elementary school. Eight students said they sometimes feel reluctant to learn ICT and acquire digital knowledge. Musah gave the following description of his state:

> "Right from elementary school, I was not adequately prepared. We had only one teacher teaching ICT in our school who was not ICT trained. So, I came to the university with no digital literacy skills, and at the university, not much is done to help some of us improve our digital skills. Due to this, I am not interested in acquiring digital skills although I know these skills are necessary" (Musah, a third-year male student).

In addition, eleven participants conceded that they were taught ICT conceptually without seeing computers and their associated equipment at the elementary school level due to the absence of an ICT lab. It also became clear that participants had trouble acquiring digital literacy skills beginning in high school, as many of their teachers discouraged the use of electronic devices like phones and laptops out of concern that students would become too distracted by social media and their online lives to focus on their schoolwork. All students agreed that instructors forbid them from using phones and laptops at school because of concerns that doing so would encourage them to hang out with undesirables and encourage the formation of a foreign culture. Teachers worried that students would be morally corrupted if they were exposed to technology at a young age because of peer pressure to participate in sexually harmful behaviours. For example, Abena said the following:

> "I remember when I was in primary school, our teacher used a stone to demonstrate a computer mouse. At the SHS, our teachers had the perception that using phones and other ICT tools may push us to engage in unhealthy sexual relationships, which may affect our studies. In this situation, how can we be digitally literate?" (Abena, a female second-year student).

Most participants reported several attempts by their Senior High School teachers to seize their phones in class and their dormitories and how sometimes teachers emphasised that they were not permitted access to phones and laptops until they entered postsecondary institutions. One participant shared her experience as follows:

> "Our headmistress, senior house mistress, and some teachers occasionally search our rooms and seize our phones. This discouraged many of us from using phones on campus, even to study. Even after SHS, I still did not have the feeling of using a phone to study because I still suffered from those shocks. In this situation, how can we be digitally literate?" (Rukia, a female second-year student).

The findings in this part shed light on the dire state of digital literacy among Ghanaian students, which begins far before they enrol in higher education and worsens the situation there. The results show that teachers in elementary and secondary schools, who should be instrumental in helping their students develop digital literacy abilities, often operate as a barrier, negatively impacting students' digital understanding and knowledge acquisition.

3.3 Low parental commitment to ICT Education (parental factor)

Also, it became clear that all participants had trouble progressing beyond a rudimentary level of digital literacy because their parents prevented them from using digital devices like phones and computers in the house for fear that doing so may undermine their moral character. Participants stated that most Ghanaian parents were ignorant and felt that exposing their children to technology in the early years would lead to moral corruption because of the things their children would learn. Most respondents said their parents only let them use electronics like phones and laptops once they got to university. For example, Abena noted the following:

> "Ghanaian parents believe that allowing their children to use a phone at a young age causes the child to deviate from proper societal norms". It is difficult to be digitally literate in such homes (Abena, a female second-year student).

Serdof also shared this view by saying that:

> "My parents only allowed me to have access to phone after completing Senior High School because they believed I may be negatively influenced" (Serdof, a female first-year student).

The findings in this section illustrate how parents, who should be instrumental in helping their children develop digital literacy at home by providing digital tools, often serve as a barrier instead of undermining their children's digital knowledge and abilities. This illustrates that teachers and parents at home contribute to students' low levels of digital literacy, exacerbating issues encountered in higher education.

3.4 The low commitment of the government toward ICT infrastructural facilities at the community and university levels (Government factor)

All participants agreed that public university ICT labs were inadequate because the Government had insufficient funds to equip such facilities adequately. They admitted that institutions could not provide students with adequate information and communication technology (ICT) resources without government support. This is one of the reasons they feel they need to improve in digital literacy. Ben explained this as follows:

> "Despite its emphasis on STEM education, the Government has not done enough to strengthen ICT at the community and school levels. Because there is no computer laboratory in my village schools, everything will be theoretical. Students are forced to memorise everything rather than gain hands-on experience, which will impact their digital literacy at the tertiary level" (Ben, a first-year male student).

Other participants felt the Government unfairly prioritised urban schools to place ICT bookstores and labs. According to them, most students are educated in under-

resourced rural schools, which may affect their level of digital literacy when they go on to higher education. Dickson spoke for himself;

> "Most basic schools in urban areas have well-equipped ICT laboratories comparable to those in rural areas like my village. Again, there are large bookshops with a variety of ICT books available in cities, but this is not the case in rural areas" (Dickson, a final-year male student).

3.5 Strengthening government and institutional commitment to ICT (government and institutional factors)

Participants were asked to provide feedback on how various governmental and educational institutions may better equip themselves to increase students' digital literacy skills and understanding. Nine participants offered suggestions for improving students' digital literacy skills and knowledge. They recommended that the Government evaluate the curriculum and prioritise practical application over theoretical study to integrate ICT into elementary and secondary education better. For instance, Faizal proposed that:

> "My first advice goes to the curriculum developers. For example, they should base policies on facts rather than hope. This will assist people in learning ICT from the ground up before proceeding to the highest level of education. They should not design the curriculum with an emphasis on theoretical rather than practical aspects" (Faizal, a third-year male student).

Other participants said that the Government and universities should increase the number of Internet-connected computers accessible at higher education institutions. Eight interviewees cited the need for a much faster Internet as a critical factor in making Internet services more accessible and usable. In the event of an institutional outage, all participants agreed that Internet service prices should be kept low so that they may still afford to acquire data. Ansong had this to say:

> "I will want the institutions to introduce ICT at all levels because we are from different backgrounds, and some people don't have access to ICT resources. They only get access to it at the tertiary level. Also, they should provide fast internet service and make it affordable for all to access in and out of campus" (Ansong, a final-year male student).

3.6 Parental and community engagement (parental and community factors)

Some participants felt that raising awareness and involving the whole Community would be the best way to improve people's digital literacy. Ten participants stated that many parents and others in the Community still believe that exposing children to digital technology would lead to moral decay. Therefore, the participants pushed

for widespread awareness to help dispel this misconception among parents and community members. Serdof had a similar viewpoint, stating:

> "I think our parents should be sensitised about using ICT tools at the early stages of our development. All community members should also be engaged. This will erase their misconception about the use of digital gadgets" (Serdof, a first-year female student).

The findings of this part shed light on how students think their digital literacy skills could be improved. The results show that students are already aware of the solutions to be adopted from macro to micro levels to solve their digital literacy problems. Students have demonstrated ways parents, community members, Government, and university institutions can adopt to improve their digital literacy skills.

4 Conclusions and discussion

This research examined students' perceptions of the reasons for and potential remedies for their digital literacy skills and knowledge gap in Ghanaian higher education. There are various complicated factors behind the digital literacy gap among students. Undergraduates have ascribed these reasons to a wide range of macro and micro factors, as the conceptual framework depicts. The students attributed their skills gap to personal, parental, institutional, and government factors, pointing to the need for concerted action from national and international policymakers and educators alike.

According to the results of the research, the digital skills and knowledge levels of students have been impacted by their interactions with the social and environmental situations that are immediately around them, as well as the reciprocal connection that already exists between them and their surroundings. Students' personal characteristics, family and community support, school and institutional factors, and governmental factors all have an effect, either directly or indirectly, on the digital literacy abilities and knowledge of undergraduate students. The research reveals, in addition, that students' unwillingness to study information and communications technology (ICT), their access to functioning technologically updated and helpful devices, and their access to the Internet all have a direct or indirect influence on the outcomes of their digital literacy. The results indicated that the absence of support for information and communication technology (ICT) infrastructure at the community and collegiate levels is to blame for the digital skills and knowledge gap among undergraduate students. As a result, the Government's policies and resources have a direct influence on students' digital literacy. This lends credence to academics like Street (2003) and Gee (2000), who maintain that different kinds of literacy are linked to different domains of life and that institutions and power dynamics determine literacy abilities.

Results show that undergraduates' digital knowledge is moulded by their interactions with others and the environment, lending credence to Bronfenbrenner's (2005; Harkonen, 2007) ecological theory that a person's development is impacted by everything in their environment and the social interrelations within. The students realise that the ramifications of lagging in the digital world are a matter in Ghana and glob-

ally. This supports UNESCO's (2019) findings that there is a severe knowledge gap regarding the level of digital literacy among adolescents and adults globally, even though this skill set is becoming increasingly crucial for accomplishing the SDG aim. This finding is consistent with the findings of Owoyokun (2022), who discovered that a critical barrier to digital literacy in Africa is a deficiency in infrastructure. Owoyokun (2022) observed that a substantial barrier is a need for more infrastructure, such as dependable energy, research facilities, and advanced learning institutions to enhance digital literacy in member states. This calls for collaborative efforts between the Government, higher education institutions, communities, parents, and all other stakeholders locally and internationally to address the issue.

However, addressing students in Ghana's digital literacy gap does not mean replicating and applying the Global North's models directly to improving digital literacy in Ghana. For instance, Warschauer (2002a, b) cautions against repeating common mistakes in the instrumentalist approach to introducing technology to developing countries, such as using too complicated equipment and insufficient training for teachers and other important players. Infrastructure built on technology cannot initiate change on its own. Therefore, educators, administrators, and policymakers at Ghana's universities must rethink their approaches to equip their students with these abilities before they reach the industry. Experts in education and the Government of Ghana must prioritise the development of first-year university students' access to a robust digital curriculum.

Undergraduates in the study are shown to be "digitally minded," as defined by Andone et al. (2007), although they are deficient in other areas of digital literacy. Even though they may have a different familiarity with or proficiency in digital media than their counterparts in the developed world, many Ghanaian undergraduates use smartphones, the web, and social media as the demographic depicts. This research lends credence to Oyedemi & Mogano's (2018) study that many university students in Africa lack the skills essential to effectively use computers in today's highly technical society, with the cost of access, social stratification, and inequalities having implications for the patterns of digital skills. In Uganda, Gakibayo et al. (2013) also found that university students in regions with insufficient I.T. resources and weak computer skills had lower rates of electronic reading and learning.

In other words, if we want students to succeed in the technologically advanced 21st century, we must become aware of their digital literacy level and help them become digitally competitive. To facilitate online academic exchange and improve students' knowledge and skill in digital literacy, the study suggests the universities in Ghana enhance the quality of their internet services, provide proper instruction on the significance of wise internet usage, make current and pertinent websites accessible to the students, and upload course materials online, especially in welcoming websites and social networks that the students frequently visit. In a similar vein, instructors at all levels and other members of the faculty should include digital media in their classes to help students feel more comfortable with the usage of digital services.

The findings show that parents believed that exposing school children to technology at a young age would cause them to become morally corrupt. This demonstrates that technology use is bound to be hampered early in life by restricted access to and lack of expertise within it. Because of this, the idea of a digital literacy divide

may also be disputed because access stratification is more influenced by political, economic, institutional, cultural, and linguistic contexts than technological advancements (Warschauer, 2002a, b).

The results suggest that children are aware of their parent's digital ignorance since parents worried their children might become corrupt if they were exposed to technology at school. This illustrates that limited availability and lack of competence with technology are inevitable barriers to technology adoption in the early years since access stratification is impacted more by political, economic, institutional, cultural, and linguistic contexts than technical developments (Warschauer, 2002a, b). Warschauer (2002a, b, 2003) argues that the availability of technology is insufficient to guarantee social transformation. Therefore, because Gee (1996) demonstrated decades ago that literacy is a contextual and social activity, perceived constraints may be equally as practical as absolute limits in limiting participation.

Undergraduate students risk marginalisation and isolation when their parents and instructors forbid them from utilising technology in these instances. This discovery also highlights the divergent perspectives on technology held by techno-utopians and techno-cynics (Boshier & Onn, 1999; Boshier, 2001). According to Boshier (2001), techno-utopians are idealists who think that technology lowers barriers to education, promotes equity, makes learning more accessible, and blurs the distinction between teachers and students. Techno-skeptics contend that technology will not significantly improve equity or access to education.

4.1 Policy implications

The policy implications will be examined using Ghana as a specific example. Still, they also apply to other less technologically advanced nations in the global south, going through technologically unstable conditions. The study has revealed several factors leading to digital literacy and skills gap among students in Ghana.

This calls for collaborative efforts between the Government, higher education institutions, communities, parents, and all other local and international stakeholders in dealing with it. In ensuring fundamental computer and information literacy competencies required for the efficient use of computer and digital resources, the Government, international organisations, NGOs, and other stakeholders, including the Ministry of Education and the Ministry of Communication and Digitalization, must step in. They must strategise on innovative ideas and enforce policies. For instance, the Ministry of Education must promote the use of mobile phones and computers among Senior High School students. The Ministry of Communication and Digitalization can subsidise laptops and smartphones for students at all levels who may be in need. With the support of other external organisations, the government of Ghana can introduce one student per laptop project to aid in improving students' digital literacy skills and knowledge.

Additionally, the University of Education, Winneba's ICT Directorate, must regularly plan classes and seminars for staff and students to use digital services and Internet resources. This would significantly expand students' access to digital learning and other services to improve their digital literacy and boost their confidence level. The study results show that insufficient ICT foundations at the elementary and secondary

school levels cause the need for digital literacy skills among undergraduate students. To put digital literacy on par with the other three literacies (reading, writing, and arithmetic), it is advised that the Government of Ghana, working under the auspices of the Ministry of Education, the Ghana Education Service, and universities, develop comprehensive, integrated, and cogent digital literacy strategies for students at all levels.

Additionally, instruction in ICTs should be offered at all levels of education, including primary, secondary, Technical, and Vocational training centres and all tertiary institutions, and should include reasonably priced digital resources. One of the factors contributing to undergraduate students' lack of digital literacy abilities on university campuses was unfavourable and inconsistent internet connectivity. Participants ascribed this to a need for adequate national telecommunications network systems and a lack of university capacity to implement effective strategies to increase internet access. The results demonstrate that while internet access is optional for all ICT integration in education, it is crucial for digital inclusion in the twenty-first century. This suggests that universities offer the minimum amount of internet service they deem reasonable, even if it needs to be more or more.

The research uncovered three key challenges that, in the eyes of undergraduates, need to be addressed to guarantee wide availability and good quality internet service. The respondents' first significant suggestion was to increase the number of computers with Internet connection at all higher institutions. Second, Internet speeds should be significantly increased to facilitate efficient and timely usage of online resources. College students' third most common suggestion is that internet service costs should be reduced. The findings show how the Internet can revolutionise teaching at all levels and equip students with essential digital skills. To provide Internet access to classrooms, the necessary infrastructure must be made accessible. The research has shown, among other things, that Internet speeds on the UEW campuses are below average. This circumstance may affect the productive use of Internet technology. This suggests that increasing bandwidth costs may not be the best solution to the many issues that arise from Internet usage.

However, the university management has to monitor the network to learn how students use it regularly. They may then use this information to make educated judgments about how to allocate bandwidth, improving efficiency. Broadband plans from Telecoms, such as providing fibre-optic technologies, have the potential to reduce the cost of internet access for educational purposes significantly, and the University of Education, Winneba, can consider joining both local and international partnerships with telecom networks and advocating for such plans. The institution also has to evaluate its computer and internet education programs constantly. This way, students may stay abreast of developments and opportunities unique to the ICT field. Instructors and students should be encouraged to work together online on assignments, questions, lecture notes, and discussions. As a result, students will learn more and become more proficient with technology.

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