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Educational digital foundations proficiency among first-year undergraduate students in Zambia: an analysis by gender, geographic origin, and prior computer studies experience

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ABSTRACT

This study investigates first-year undergraduate students' self-reported proficiency in Educational Digital Foundations (EDFs) at a university in Zambia. The study is guided by the Social Constructivist Theory, Self-Efficacy Theory and Three-Level Digital Divide framework. It explores how gender, geographic origin and prior computer studies experience influence students' digital competencies. Using a self-reporting questionnaire with a 5-point Likert scale, data from 255 students (123 males, 132 females) were analysed via exploratory factor analysis, descriptive statistics, ordinal logistic regression and structural equation modelling. Findings indicate that students perceive themselves as moderately proficient ($M = 3.55$ and $SD = 0.99$) in EDFs. The study also revealed higher proficiency in Information Retrieval ($M = 3.98$) and lower in Data Handling ($M = 3.25$). Male students and those from urban areas reported higher proficiency in EDFs than their female and rural counterparts. Student prior computer studies experience did not predict EDFs proficiency. This suggests gaps in the secondary school ICT curriculum. Structural equation modelling revealed a strong correlation between Data Handling and Information Retrieval (.83). Information Presentation showed a relatively weaker correlation with the other two key factors (correlation coefficient of .46 for Data Handling and .49 for Information Retrieval).

IMPACT STATEMENT

This study highlights the need for ICT curricula to address disparities linked to issues such as gender and geographic origins in ensuring equitable digital literacy for higher education and future employment. Policymakers and educators can leverage the findings of this study to design interventions for underrepresented groups.

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Technology in Education; Urban Education; Higher Education; Secondary Education; Educational Technology; Teaching & Learning - Education

Introduction

Higher education institutions are increasingly tasked with equipping students from diverse socioeconomic and educational backgrounds with skills that are necessary for academic success in a rapidly digitising academic environment. In countries such as Zambia where disparities in gender, geographic origin and access to quality education pose significant barriers, universities are working to close this gap. Mukuka and Alex (2025) noted that students' proficiency in foundational digital skills has become a major goal in Zambia and the Sub-Saharan African region.

However, scholars such as Araújo-Vila et al. (2020) found that students often lack proficiencies that are required to be successful in the use of ICT in their learning, resulting into challenges in applying the required skills.

This issue is exacerbated by the common assumption that students entering the universities are proficient in digital technologies. Morgan et al. (2022) warns, 'assumptions that this generation of students

are digitally savvy may lead to educators neglecting the skills needed for academic ... success, failing to integrate digital literacy into curriculum as a core, foundational competency requirement' (p. 262).

It is statements such as those made by Morgan et al. (2022) that raise concern. They create doubt about student readiness for autonomous learning in technology-integrated academic environments (Hardy et al., 2009). It is such concerns that prompted institutions worldwide to introduce ICT courses designed to equip students with necessary technological skills. For example, Spikol et al. (2022) highlights how preparatory courses in Denmark aim to bridge gaps in students' computing knowledge. This strategy is echoed in the university where the current study was conducted through the introduction of a mandatory course called Communication and Information Technology Systems (CIS). This initiative reflects global and local efforts to address disparities in digital literacy.

The current study focuses on student proficiencies in Educational Digital Foundations (EDFs). In this study, proficiencies that are important for students entering higher education institutions are referred to as EDFs. The study addresses concerns regarding undergraduate students' preparedness to autonomously apply EDFs in technology-integrated higher education environments. It should be noted that literature that specifically address EDFs, as presented in this study, was unavailable. Consequently, ICT-related studies were referenced, particularly in the literature review in order to provide relevant context.

Proficiency in digital literacy encompasses a range of skills. This study will focus on proficiencies identified to be important for students entering higher education. Adarkwa (2024) highlights that in the digital era, the overwhelming volume of available content requires strong information literacy in students. Despite such challenge, Adarkwa argues that there are still concerns about the adequacy of the training students receive to prepare them for the digital era.

This study is guided by Social Constructivist Theory (Vygotsky, 1978), Self-Efficacy Theory (Bandura, 1997), and Van Dijk (2020) Three-Level Digital Divide framework. These perspectives provide a lens for understanding how gender, geographic origin and prior computer studies experience contribute to students' perceived proficiency in EDFs. Van Dijk's framework contextualises the study by highlighting structural disparities that may affect students' EDFs competencies. In this context, technological proficiency is defined as the ability to effectively integrate digital tools into the learning process to enhance academic outcomes (Saad & Sankaran, 2020). This study adopts Saad and Sankaran's perspective, with a specific focus on self-reported student proficiencies in EDFs.

Gap in literature

Despite the increasing integration of digital technologies in education, research has paid limited attention to understanding students' digital proficiencies in educational contexts of digital literacy and relating it to issues such as beliefs and behaviours (Martzoukou et al., 2020). While digital literacy has been widely researched in higher education (e.g. Bachmann & Hertweck, 2025; Zhao, Pinto Llorente et al., 2021) existing research predominantly focuses on broad ICT proficiencies rather than EDFs that are required for students transitioning into university. For example, Zhao, Sánchez Gómez et al. (2021) conducted a study in China, revealing that students generally held positive perceptions of their digital competencies in information, data literacy and communication skills. However, such studies overlook EDFs that are critical for student academic success in higher education.

Moreover, majority of previous research (e.g. Bachmann & Hertweck, 2025) ; Hidalgo et al., 2020; has been conducted in developed countries. This has left a significant gap in understanding the digital literacy landscape in developing countries such as Zambia. Therefore, this study addresses this gap by focusing on EDFs as a distinct subset of digital literacy. This is particularly in contexts where digital infrastructure and access differ from those in developed regions or countries such as China.

It must be noted that digital infrastructure and access to technology in Zambia, present unique challenges that are not adequately captured in existing literature. By investigating gender, geographic origins and prior computer studies experience in this context, the current study provides empirical evidence that can inform curriculum design and policy interventions that is aimed at bridging the digital disparities at learning institutions that are in similar contexts as the university where the study was conducted.

Context

This study was conducted at a university in the Copperbelt Province of Zambia, where the CIS course was mandatory to all first-year students except those in computer-related programmes. Those in computer-related programmes were offered alternative computer courses tailored to their specific programmes. The CIS course focused on developing EDFs alongside topics such as computer system fundamentals, cybersecurity and ethical issues in technology. By focusing on Zambia's context, this study offers insights into the complexities of EDFs in higher education to help make recommendations for policy and practice.

The integration of ICT into education has become an important issue in the enhancement of student academic performance (Luchembe & Shumba, 2020, 2022). In Zambia, this effort is reflected in the introduction of Computer Studies at the junior level aimed at developing basic ICT skills and at the senior level aimed at promoting creative and analytical proficiencies in technology.

Despite challenges in digital literacy, Zambia has made significant strides in its digital transformation journey, with improvements in digital infrastructure, financial services and technological platforms (World Bank, 2020). In 2021, the Zambian government announced plans to further enhance technology access by building additional communication towers, particularly in underdeveloped areas (Government of the Republic of Zambia, 2021). However, despite this progress, challenges remain, particularly in the acquisition and use of ICT in secondary schools. This difficulty is not unique to the Zambian situation. According to Aruleba and Jere (2022) many developing countries are striving to integrate technology into their education system amidst resource constraints.

Scholars such as Konayuma et al. (2023) have highlighted that 'many primary and secondary schools have lagged in terms of ICT acquisition and use' (p. 27). This reflects a broader challenge of ensuring access to digital resources and use across educational institutions. This theme resonates with educators, researchers, and policymakers globally (e.g. Erstad et al., 2021; Weninger, 2022). These insights into Zambia's technological landscape reflects both progress and challenges in digital literacy. This makes digital literacy a critical area of focus for universities and policymakers alike.

Literature review

Zhao, Pinto Llorente et al. (2021) identified five key factors influencing real digital skills: 'gender, previous digital experience, received training, number of research and innovation projects participated in, teaching experience and the use of technology' (p. 9). Apart from gender and educational level, Hidalgo et al. (2020), includes age, income and habitat to have the potential to influence the development of digital skills among learners. These issues are particularly important in the use of ICT in education as discussed in this literature review.

Morgan et al. (2022) found that students demonstrated the lowest proficiency in digital information usage, particularly in evaluating information, assessing bias, and determining its quality. In contrast, they demonstrated the highest proficiency in social literacy skills, such as engaging in appropriate online communication. Zhao, Sánchez Gómez et al. (2021) found significant variations in students' self-perceived digital competence across areas such as gender, area of residence and prior relevant formal training in ICT. These findings illustrate the importance of considering such factors when examining student digital literacy. Therefore, building on these insights, the study narrows its focus on EDFs to three issues: gender, geographic origin and prior computer studies experience.

Digital literacy

Digital literacy has emerged as an important skill in secondary and higher education where it influences student effectiveness, engagement and success. According to Morgan et al. (2022), 'digital literacy involves the use and scrutiny of information and sources of information, as well as the creation of knowledge' (p. 259). Scholars such as Ndibalema (2025) have emphasised the crucial role of digital literacy in higher education by describing it as indispensable for navigating complex digital environments. This view is echoed as educational institutions integrate technology into their curricula. Dolničar and Boh

(2024) found a significant association between students' digital literacy and their confidence in both search engine use and social media engagement. This shows how proficiencies in specific areas can reflect students overall digital literacy.

Morgan et al. (2022) found that students generally perceived themselves as proficient in areas such as accessing of academic resources, database information and website content. They also found that students rated themselves as confidence in areas such as navigating large volumes of information, critically assessing its relevance, generating new insights, and sharing knowledge. However, the overall findings indicated only a moderate level of reported proficiency.

However, other scholars such as Lucas et al. (2022) found that their research results challenged the common assumption that ICT students are more digitally competent than their peers in other fields. This indicates that proficiencies in EDFs are not exclusive to ICT students. Therefore, studies perceived student proficiency to be influenced by other factors such as gender and geographic origins. Therefore, the following review examines relevant studies on gender, geographic origin (rural/urban) and prior computer studies experience in the context of digital literacy.

Gender

Girelli (2023) defines gender as the differences between males and females that are primarily shaped by environmental factors. Gender gap in digital skills is a challenge, with some studies revealing disparities between male and female students. In this study, students self-reported their gender. Researchers such as Bachmann and Hertweck (2025) and Martínez-Cantos (2017) observed that gender influences student self-assessments of digital proficiencies. They observed that males reporting higher scores than female.

Lucas et al. (2022) found that that males tend to score higher than females in ICT. Zhao, Sánchez Gómez et al. (2021) found that male students' perception of their digital competence level in information and data literacy was significantly higher than that of women. However, they found no significant difference between genders in the area of communication and collaboration. This implies that in the areas that contained EDFs, disparities between male and female students were observed.

Abima et al. (2021) highlighted that high illiteracy rates among females, combined with limited access to ICT training, contribute to their limited digital skills development and confidence in using digital technologies. According to Campos and Scherer (2024), 'gender gaps in digital knowledge and skills could be partly explained by gender differences in attitudes towards technology' (p. 674). Tondeur et al. (2016) argues that while women generally have less positive attitudes towards computers, their attitudes towards using computers for educational purposes were comparable to men's and were context-dependent. This implies that student use of technology may not be due to inherent preferences but rather from the specific contexts in which the technology is applied. This underscores the need for contextual approaches to addressing gender disparities in ICT use in educational settings.

Gender-related differences in ICT use, as noted by Bachmann and Hertweck (2025), may extend to how male and female students regard their proficiency in EDFs. Males exhibit higher proficiency in ICT-related tasks due to societal encouragement (Comber et al., 2021), leading to a more confident and efficient approach to understanding EDFs. On the other hand, female students might perceive digital tasks as more challenging, potentially due to low regards for their proficiency in EDFs. These gender-related differences in ICT use suggest that societal influences play an important role in students' confidence in their EDFs proficiency.

According to Koinig et al. (2020), low literacy rates in regions such as Africa and Asia contribute significantly to the persistence of the digital divide and the gender gap. According to Van Dijk (2020), digital divide is the disparity in technology usage which reflects variations in access to technology, information and ICT skills and the ways individuals utilise technology. In Sub-Saharan Africa, Alozie and Akpan-Obong (2017) conducted a study involving six countries (Ghana, Kenya, Nigeria, Senegal, South Africa and Uganda) where they observed a gender gap with males performing better than female. However, they cautioned against making speculative claims or sweeping generalisations about the influence of gender on ICT, noting that some countries were performing significantly better in regards to gender issues.

Therefore, these differences may lead to varying outcomes in student reported proficiencies in EDFs. Therefore, exploring these complexities is important for gaining an understanding of the relationship between ICT and gender. This also explains why gender was particularly pertinent to this study.

Geographic origin (rural/urban)

Geographic origin in terms of rural and urban origins of students has been considered in this study. Students from urban and rural areas have differing levels of technology exposure, with rural schools often lacking ICT infrastructure (Lembani et al., 2020). Limited internet connectivity and insufficient private investment in rural areas contribute to a digital divide Aruleba and Jere (2022), potentially disadvantaging rural students academically compared to their urban counterparts.

Cheng and Yang (2023) observed that limited access to high-quality educational technological resources hinders rural students' academic achievement and development of essential 21st century skills, such as digital literacy. Martzoukou et al. (2025) observed that while geographical origins did not directly influence students' self-assessment of specific digital proficiencies, they significantly contribute to students' perceived digital abilities in the context of overall academic work.

A study by Zhao, Sánchez Gómez et al. (2021) and found that urban students self-reported higher proficiency in digital literacy than their rural counterparts. This could be due to a number of reasons. For example, students from rural areas often face limited access to ICT resources (Lembani et al., 2020), which impacts their observational learning experiences. Rural students have fewer opportunities for social persuasion and modelling. This limit their ability to develop effective strategies for managing digital content, leading to heightened lower regard for their proficiency. Additionally, geographic origin which are categorised into rural and urban areas are a key aspect of the sociocultural background of students entering the university. It's also important to include prior computer studies experience in this study.

Prior computer studies experience

Scholars such as Martzoukou et al. (2020) have noted a lack of studies that focus on understanding students' digital proficiencies while at the same time examining their pre-developed digital skills. However, studies that have examined this issues have found that secondary school ICT courses help pupils improve their ICT skills when in higher education. Senkbeil (2022) observed that 'prior knowledge is probably the most important determinant of student achievement' in ICT skills (p. 3597). Zhao, Sánchez Gómez et al. (2021) found significant disparities across all investigated areas of digital literacy between students with and without prior formal training, with those possessing training reporting higher self-assessed proficiency than those without prior computer studies experience. This shows that formal ICT training in secondary school improves university students' ICT proficiency.

Unlike in the past, students enter universities with diverse ICT skills and access to modern technologies such as smartphones, which they utilise for both academic and social purposes (Oyedemi & Mogano, 2018). Developing these skills is critical for increasing both student quality of life and academic performance in higher education (Rodrigues et al., 2021). The current study is important in that it examines the interplay between students' prior computer studies experience and their proficiency in EDFs in a Zambian higher education setting.

Theoretical framework

The theoretical framework of this study is grounded in an integrated framework that combines social constructivist theory (Vygotsky, 1978), Self-Efficacy Theory (Bandura, 1997) and Van Dijk (2020) Three-Level Digital Divide Framework. These perspectives are combined in order to provide a multidimensional understanding of how undergraduate first year students perceive their EDFs in connection to social interaction and cognitive beliefs. Additionally, the study focuses on structural inequalities in relation to disparities in EDFs proficiency of students of various backgrounds.

Social Constructivist Theory emphasises the role of the environment in determining students' proficiency in EDFs. Self-Efficacy Theory explains students' perceived proficiencies in EDFs. Dixon et al. (2024)

noted that in Bandura's self-efficacy theory, 'there is an 'expectancy of success' belief which can be explained as the belief that a desired outcome is achievable' (p. 592). This explains why 'self-report' is considered to be important in this study. Self-Efficacy Theory provide the lens to view how students' beliefs about their own capabilities contribute to their perceived proficiency in EDFs. Van Dijk's framework contextualises disparities in student access to, among other things, digital technology. This framework offers a structured approach in analysing how gender, geographic origin and prior computer studies experience contribute to student perceived EDFs proficiency. Therefore, the current study situates EDFs within sociocultural, psychological and structural influences. The incorporation of the social constructivist theory, Self-Efficacy Theory and the Three-Level Digital Divide framework in the current study does not position them as the primary focus but rather as a means of understanding students' proficiencies in the EDFs. This theoretical approach enables a comprehensive exploration of first-year undergraduate students' perceived proficiencies in EDFs.

Conceptual framework

The conceptual framework illustrated in [Figure 1](#) guides this study. It shows students entering the university with diverse backgrounds. Incoming students' characteristics are represented by the 'Predictors' box. These are independent variables (gender, geographic origin, and prior computer studies experience) that may influence students' proficiencies in EDFs. They are predictors that create a link between incoming students and their proficiencies in EDFs. These predictors are expected to exert a significant influence on the level of students' EDFs proficiencies. This framework, guides the study by outlining the relationship between incoming students' characteristics and their perceived proficiencies in EDFs.

In this study, the Self-Efficacy Theory (Bandura, 1997) help understand incoming students' perceptions of their proficiencies in EDFs. Van Dijk (2020) Three-Level Digital Divide Framework, helps categorises proficiencies into two broad groups with a focus on student perceived EDFs in the way they use technology:

- EDFs Proficient – refers to self-reported scores which are average or above average
- Lacking EDFs – refers to self-reported scores which are below average.

The integration of Social Constructivist Theory (Vygotsky, 1978) in the studt help explain possible reasons for the disparities observed in students' EDFs proficiencies based on gender, geographic origin and prior computer studies experience.

Additionally, there is a green arrow connects 'EDFs Proficient' to 'Key Factors'. The Key Factors in this case are latent variable that represents a group of related incoming student proficiencies in EDFs. The interplay between these Key Factors will be examined. This framework underscores the expected influence of gender, geographic origin and prior computer studies experience as main predictors of students' perceived proficiencies in EDFs. Therefore, this approach provides a holistic lens to understand first-year undergraduate students' perceived proficiencies in EDFs.

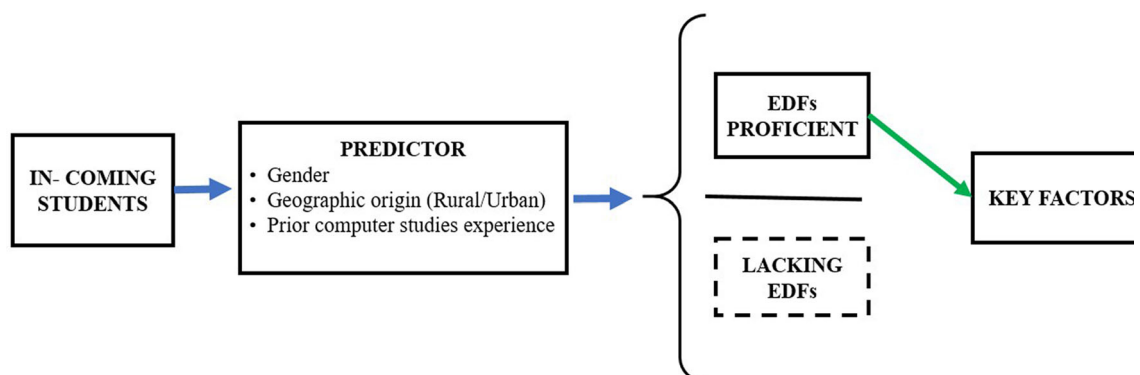


Figure 1. Conceptual framework for studying student perceived proficiency in EDFs.

Research questions

The study is guided by the following three research questions:

RQ 1. How do students perceive their proficiency in EDFs?

RQ 2. To what extent do gender, geographic origin and prior computer studies experience serve to predict student proficiency in EDFs?

RQ 3. How do the underlying Key Factors that characterise students' perceived proficiency in EDFs relate to each other?

Research method

The study was conducted at the middle of the first term of the first academic year of 2023. The study, adopted an exploratory and quantitative approach. It utilised a student self-reporting questionnaire that was designed by the researcher. It must be noted that scholar such as Synnott et al. (2020) have found a positive correlation between perceived student technology proficiency and actual digital skills. This observation further justifies the use of self-reported questionnaires in the current study.

Population and sample size

Out of a total population of 755 first-year undergraduate students, a sample of 255 was randomly selected to participate in the study. This was done using a 95% confidence level and a 5% margin of error.

Table 1 depicts a snapshot of the student population under study. It includes information about the students' gender and number of students who studied computer science in secondary school.

Data collection and analysis procedures

Ulfert-Blank and Schmidt (2022) highlighted that digital proficiencies can be measured using self-report scales. Therefore, a questionnaire was utilised in this study. It was administered to collect data on student self-reported proficiencies in EDFs. The questionnaire was distributed by the researcher to the selected students. The sample consisted of first-year undergraduate students who reported their proficiency in EDFs on a Likert scale from 1 ('Very Poor') to 5 ('Very Good'). Therefore, the maximum score that was achieved per item was 5 and the minimum was 1.

The initial version of the questionnaire was reviewed by two lecturers with experience in using similar instruments in their own studies. Their feedback was considered and appropriate revisions made. As a result, the questionnaire items were reduced from 18 to 15. For this research, a pilot study was conducted a year before the main study in order to assess the appropriateness of the questionnaire items. Student responses to the Likert scale items were analysed using SPSS version 26. The reliability of the questionnaire was evaluated using Cronbach's alpha. It yielded a reliability coefficient of .84.

The main study employed exploratory factor analysis, descriptive statistics, ordinal logistic regression and structural equation modelling. The first part employed exploratory factor analysis to examine the group of independent variables in order to identify representative Key Factors that reflected patterns in student EDFs proficiency. The second part of data analysis mainly involved the use of descriptive statistics. Specifically, means and standard deviations. Additionally, effect size was calculated to assess the

Table 1. Descriptive statistics of sample characteristics (n = 255).

Gender	Number of students	Geographic origin		Computer studies experience	
		Urban	Rural	Yes	No
Male	134	59	75	63	60
Female	121	64	57	75	57
Total	255	123	132	138	117

practical significance of the observed differences. Effect sizes were categorised based on Cohen's (1988) guidelines: small ($d = 0.2$), medium ($d = 0.5$) and large ($d = 0.8$).

The third part of data analysis involved the use of ordinal logistic regression analysis (Agresti, 1989). This form of analysis was employed to examine gender, geographic origin and prior computer studies experience as predictors of students' proficiency in EDFs. Each proficiency was entered in SPSS as a dependent variable while the three predictors were entered as independent variables.

The Wald test (significance threshold, $p < .05$) was used to assess the significance of individual predictors for each proficiency. Proficiencies with non-significant predictors were excluded in the final models to simplify the analysis. Model evaluation involved calculating Nagelkerke R^2 (Nagelkerke, 1991) to assess goodness-of-fit and testing of the proportional odds assumption using the parallel lines test.

The last part of data analysis involved the use of structural equation modelling. This approach provided insights into relationships between variables and enables the identification of patterns (Yaqin et al., 2025). This approach allowed for a more detailed examination of relationships between latent constructs. Therefore, incorporating this approach offered a comprehensive understanding, as structural equation modelling helped explain the underlying reasons behind students' self-reported proficiencies in EDFs. To determine the adequacy of each observed variable in representing the corresponding latent construct, factor loading of 0.60 and higher were considered to be acceptable.

Results

Exploratory factor analysis

Exploratory factor analysis helped identify latent constructs underlying students' self-reported proficiency in EDFs and group related variables into distinct Key Factors that represented dimensions of EDFs proficiency. To assess the suitability of using exploratory factor analysis in the study, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test were performed (Wahyuni et al., 2024). The results indicated that the value of KMO (.888), being greater than .5, and the significance of Bartlett's test (.000), being below .05, confirm the presence of sufficient correlations among the variables. Therefore, exploratory factor analysis was used.

Exploratory factor analysis was conducted using the principal component extraction method with Varimax rotation. Key Factors were selected based on eigenvalues greater than 1 as the extraction criterion. The eigenvalue criterion resulted in 3 Key Factors as indicated in Table 2. These Key Factors explained 65.13% of the total variance, meaning that a significant proportion of the variability in EDFs was captured by these factors. Therefore, the three constructs identified in this study represented the Key Factors in students' self-reported proficiencies in EDFs.

Table 2. Matrix of rotated components.

Proficiencies	Factors		
	1	2	3
Typing	.643	-.320	.352
Proofreading	.725	-.280	.276
Data input in spreadsheet	.710	-.132	.418
Data analysis in spreadsheet	.722	-.265	.138
Use of search engines	.749	-.270	-.302
Searching for specific keywords	.757	-.330	-.142
Familiarity with search engines	.720	-.301	.272
Locating study materials	.716	-.252	-.479
Using YouTube for educational information	.707	-.207	-.446
Effectiveness in searching for solutions	.574	.552	-.078
Creation of visually appealing slides	.612	.496	-.098
Use of slides	.574	.529	-.114
Assignment presentation	.508	.541	.091
Using of animations	.406	.563	.124
Formatting of text/images	.479	.544	.102

The reliability analysis was conducted using Cronbach's Alpha. This analysis yielded a value of .90, indicating a high level of reliability. Homogeneity index were determined for each item in order to assess the internal consistency of the items in the questionnaire. Items with a homogeneity index below .2 were checked for removal. This approach was also used in a study by Gómez-García et al. (2023). However, in the current study no items were removed, as all homogeneity index values exceeded .2. This indicated that each item contributed adequately to the overall scale reliability.

Factor 1

Accounted for 42.10% of the total variance. This Key Factor encompassed technical proficiencies such as Typing, Proofreading, Data input in spreadsheet and Data analysis in spreadsheet. It reflected proficiencies essential for managing and processing digital information efficiently. Factor 1 was referred to as 'Data Handling'.

Factor 2

Accounted for 15.89% of the total variance. The Key Factor represents the ability to effectively search and locate information online. It included proficiencies in Use of search engines, Searching for specific keywords, Familiarity with search engines, Locating study materials, Using YouTube for educational information and Effectiveness in searching for solutions. This key factor was called 'Information Retrieval'.

Factor 3

Accounted for 7.14% of the total variance. This Key Factor captured skills related to presenting and conveying information effectively. It includes confidence in Creation of visually appealing slides, Use of slides, Assignment presentation, Using of animations and Formatting of text/images. This third key factor was referred to as 'Information Presentation'.

Descriptive analysis

Descriptive statistics were utilised to analyse both the overall and each key factor, as well as proficiency levels in order to provide a comprehensive overview of the students' proficiency in EDFs. Table 3 shows student reported level of proficiency in EDFs. The mean self-reported proficiency across all students was $M = 3.55$ and $SD = 0.99$.

Therefore, students perceived themselves as moderately proficient in EDFs. The highest confidence was in Information Retrieval ($M = 3.98$), especially in using YouTube and search engines. Which according to the Dolničar and Boh (2024) indicates student level of digital literacy. Data Handling proficiencies

Table 3. Students' perception of their proficiency in EDFs.

Key factor	Proficiency	M	SD
Data Handling ($M = 3.25$, $SD = 1.03$)	Typing	3.44	1.01
	Proofreading	3.24	1.07
	Data input in spreadsheet	3.19	0.98
	Data analysis in spreadsheet	3.11	1.07
	Use of search engines	4.13	0.86
Information Retrieval ($M = 3.98$, $SD = 0.92$)	Searching for specific keywords	3.95	0.95
	Familiarity with search engines	4.00	0.92
	Locating study materials	3.76	1.01
	Using YouTube for educational information	4.23	0.87
	Effectiveness in searching for solutions	3.79	0.90
Information Presentation ($M = 3.27$, $SD = 1.02$)	Creation of visually appealing slides	3.35	1.04
	Use of slides	3.27	1.06
	Assignment presentation	3.35	0.93
	Using of animations	3.16	1.06
	Formatting of text/images	3.22	1.10

M = Mean, SD = Standard deviation.

Table 4. Students' perception of their proficiency in EDFs by gender.

Key factor	Proficiency	Male		Female		t-value	p value	Effect Size
		M	SD	M	SD			
Data Handling	Typing	3.54	1.13	3.33	0.88	2.21	.028	.29
	Proofreading	3.31	1.10	3.17	1.03	1.98	.049	.24
	Data input in spreadsheet	3.14	1.01	3.24	0.94	1.55	.122	.15
	Data analysis in spreadsheet	3.19	1.12	3.05	1.02	2.05	.041	.25
Information Retrieval	Use of search engines	4.21	0.91	4.05	0.81	2.02	.045	.26
	Searching for specific keywords	3.99	1.04	3.90	0.85	1.75	.089	.18
	Familiarity with search engines	4.01	0.99	4.00	0.86	1.68	.097	.17
	Locating study materials	3.74	0.98	3.78	1.04	0.45	.651	.05
	Using YouTube for educational information	4.20	0.85	4.26	0.90	1.25	.21	.13
	Effectiveness in searching for solutions	3.70	0.95	3.87	0.94	1.72	.089	.18
	Creation of visually appealing slides	3.41	1.12	3.28	0.96	1.91	.057	.22
Information Presentation	Use of slides	3.30	1.16	3.23	0.96	1.84	.063	.21
	Assignment presentation	3.46	0.98	3.23	0.87	2.03	.043	.27
	Using of animations	3.28	1.11	3.06	1.01	2.09	.037	.25
	Formatting of text/images	3.30	1.15	3.15	1.04	1.35	.178	.14

M = Mean, SD = Standard deviation.

Table 5. Students' perception of their proficiency in EDFs by geographic origin.

Key factor	Proficiency	Urban		Rural		t-value	p value	Effect Size
		M	SD	M	SD			
Data Handling	Typing	3.51	0.97	3.35	1.04	2.05	.042	.25
	Proofreading	3.32	1.08	3.15	1.04	1.98	.048	.24
	Data input in spreadsheet	3.31	0.98	3.07	0.95	2.85	.005	.30
	Data analysis in spreadsheet	3.21	1.01	3.01	1.12	2.19	.029	.26
Information Retrieval	Use of search engines	4.21	0.80	4.05	0.92	2.15	.032	.25
	Searching for specific keywords	4.01	0.94	3.87	0.95	1.79	.075	.18
	Familiarity with search engines	4.07	0.93	3.93	0.91	1.64	.102	.17
	Locating study materials	3.82	1.01	3.69	1.00	1.95	.052	.20
	Using YouTube for educational information	4.29	0.85	4.17	0.88	1.88	.061	.19
	Effectiveness in searching for solutions	3.91	0.90	3.65	0.97	2.49	.013	.28
	Creation of visually appealing slides	3.37	0.98	3.32	1.09	1.75	.080	.18
Information Presentation	Use of slides	3.29	1.07	3.24	1.04	1.69	.091	.17
	Assignment presentation	3.40	0.95	3.28	0.90	2.04	.044	.25
	Using of animations	3.16	1.04	3.17	1.09	0.12	.905	.01
	Formatting of text/images	3.21	1.05	3.24	1.14	0.32	.751	.03

M = Mean, SD = Standard deviation.

were rated lowest ($M = 3.25$), with data analysis in spreadsheets having the least proficiency under this key factor.

Coming to perception by gender, the findings in Table 4 suggest a general trend that showed that, generally, male students reported higher mean proficiencies in EDFs ($M = 3.59$, $SD = 1.04$) compared to their counterparts.

On the other hand, females generally demonstrated lower ($M = 3.51$, $SD = 0.94$) proficiencies. The results for females also showed lower variability. This indicated consistency in female student self-reporting.

A two-tailed independent samples t-test was conducted to compare self-reported EDFs proficiency between male and female students. The results indicated that male students reported significantly higher proficiency than female students in several areas such as Typing, Use of Search Engines, Assignment Presentation and Using Animations. For example, Typing for male students scored significantly higher ($M = 3.54$, $SD = 1.13$) than female students ($M = 3.33$, $SD = 0.88$), $t(253) = 2.21$, $p = .028$, $d = 0.29$. Most of the effect sizes in Table 4 are small or above the small threshold ($d = 0.2$) but not reaching the medium ($d = 0.5$) or large ($d = 0.8$). This indicates that while there are statistically significant gender differences in students' perceptions of their proficiency in EDFs, these differences are relatively modest in terms of practical significance.

Table 5 shows perceptions of student proficiencies in EDFs based on geographic origin. Generally, students from urban areas reported higher average proficiency ($M = 3.61$, $SD = 0.97$) compared to those from rural areas ($M = 3.48$, $SD = 1.00$).

Table 6. Students' perception of their proficiency in EDFs by prior computer studies experience.

Key factor	Proficiency	Prior computer studies		No prior computer studies		t-value	p-value	Effect Size
		M	SD	M	SD			
Data Handling	Typing	3.41	1.00	3.46	1.02	0.72	.472	.05
	Proofreading	3.30	1.08	3.17	1.05	1.34	.181	.13
	Data input in spreadsheet	3.28	0.94	3.09	1.01	2.02	.044	.26
	Data analysis in spreadsheet	3.20	1.05	3.01	1.09	1.89	.059	.24
Information Retrieval	Use of search engines	4.09	0.94	4.17	0.75	1.12	.265	.12
	Searching for specific keywords	3.87	1.01	4.03	0.87	1.76	.079	.19
	Familiarity with search engines	3.96	0.96	4.05	0.88	1.08	.281	.11
	Locating study materials	3.79	1.05	3.73	0.96	0.56	.573	.06
	Using YouTube for educational information	4.32	0.85	4.13	0.90	2.14	.034	.28
	Effectiveness in searching for solutions	3.85	1.00	3.72	0.87	1.41	.161	.15
Information Presentation	Creation of visually appealing slides	3.36	1.02	3.33	1.07	0.32	.746	.03
	Use of slides	3.25	1.06	3.29	1.07	0.40	.689	.04
	Assignment presentation	3.38	0.94	3.30	0.92	1.01	.313	.10
	Using of animations	3.14	1.08	3.19	1.05	0.45	.652	.05
	Formatting of text/images	3.22	1.12	3.23	1.08	0.08	.937	.01

M = Mean, SD = Standard deviation.

A two-tailed independent samples t-test was used to compare self-reported EDFs proficiency between urban and rural students. The results revealed that urban students reported significantly higher proficiency than rural students in Typing, Data Input in Spreadsheets, Data Analysis in Spreadsheets, Use of Search Engines and Effectiveness in Searching for Solutions. For example, Data Input in Spreadsheets for urban students ($M = 3.31$, $SD = 0.98$) was significantly higher than for rural students ($M = 3.07$, $SD = 0.95$), $t(253) = 2.85$, $p = .005$, $d = 0.30$. Even in this case most of the effect sizes in Table 5 are small or just above the small threshold ($d = 0.2$). These results indicate that geographic origin may influence students' perceived competencies to some extent, but the practical significance of these differences is limited.

The results in Table 6 shows that overall, students with prior computer studies experience had a higher proficiency ($M = 3.56$, $SD = 1.01$) compared to those without such experience ($M = 3.53$, $SD = 0.97$).

A two-tailed independent samples t-test was conducted to compare self-reported proficiencies for students who had prior computer studies experience and those who did not. The results indicate that students with prior computer studies experience reported slightly higher proficiency in Data Input in Spreadsheets and Using YouTube for Educational Information. For example, Data input in spreadsheet for students with prior experience ($M = 3.28$, $SD = 0.94$) was higher compared to those without prior experience ($M = 3.09$, $SD = 1.01$), $t(253) = 2.02$, $p = .044$, $d = 0.26$. Most of the effect sizes in the table fall into small category ($d = .2$). Therefore, even these results suggest that while there are some statistically significant differences between students with and without prior computer studies experience, these differences are generally small in magnitude. This implies that prior computer studies experience's contribution to students' perceived competency in EDFs is minor.

Ordinal logistic regression analysis

An ordinal logistic regression was conducted to examine the extent to which gender, geographic origin and prior computer studies experience predicted students' proficiency in EDFs. Results are illustrated in Table 7.

Wald coefficients were significant for typing ($p = .02$), assignment presentation ($p = .03$), using animations ($p = .05$), use of search engines ($p = .04$), data input in spreadsheets ($p = .04$), effectiveness in searching for solutions ($p = .05$) and using YouTube for educational purposes ($p = .05$). As a result, these proficiencies were retained in the final ordinal logistic regression model as illustrated in Table 8.

Proficiencies that were retained are illustrated in the final ordinal logistic regression model. Proficiencies that were non-significant were excluded in order to simplify the models.

Prior computer studies experience was included in the initial analysis but did not significantly predict any proficiencies, as none of its Wald tests reached the significance threshold. Consequently, it was

Table 7. Initial ordinal logistic regression model.

Proficiency	Predictor	Wald	Sig.
Typing	Gender*	5.14	.02
	Geographic origin	1.23	.27
	Prior computer studies experience	0.52	.47
Proofreading	Gender	2.06	.15
	Geographic origin	1.75	.19
	Prior computer studies experience	1.09	.30
Data input in spreadsheet	Gender	0.76	.38
	Geographic origin*	4.34	.04
	Prior computer studies experience	2.37	.12
Data analysis in spreadsheet	Gender	1.42	.23
	Geographic origin	2.22	.14
	Prior computer studies experience	1.60	.21
Use of search engines	Gender*	4.21	.04
	Geographic origin	1.34	.25
	Prior computer studies experience	1.18	.28
Searching for specific keywords	Gender	2.09	.15
	Geographic origin	1.71	.19
	Prior computer studies experience	0.41	.52
Familiarity with search engines	Gender	0.22	.64
	Geographic origin	2.02	.16
	Prior computer studies experience	0.41	.52
Locating study materials	Gender	0.14	.71
	Geographic origin	1.07	.30
	Prior computer studies experience	0.37	.54
Using YouTube for educational information	Gender	0.72	.40
	Geographic origin	1.69	.19
	Prior computer studies experience*	3.56	.05
Effectiveness in searching for solutions	Gender	1.84	.18
	Geographic origin*	3.81	.05
	Prior computer studies experience	2.38	.12
Creation of visually appealing slides	Gender	1.53	.22
	Geographic origin	0.01	.93
	Prior computer studies experience	0.00	.96
Use of slides	Gender	0.77	.38
	Geographic origin	0.03	.85
	Prior computer studies experience	0.25	.62
Assignment presentation	Gender*	4.96	.03
	Geographic origin	0.86	.35
	Prior computer studies experience	0.08	.78
Using of animations	Gender*	3.40	.05
	Geographic origin	0.17	.68
	Prior computer studies experience	0.00	1.00
Formatting of text/images	Gender	1.31	.25
	Geographic origin	0.16	.69
	Prior computer studies experience	0.02	.89

Wald coefficients indicate statistical significance for proficiencies marked with an asterisk (*).

excluded from the final models. The final models were evaluated using the Nagelkerke R^2 for goodness-of-fit and the parallel lines assumption as shown in [Table 9](#).

The results show that gender and geographic origin had limited explanatory power for predicting various proficiencies. This was indicated by the low Nagelkerke R^2 values which ranged from .015 to .030. The parallel lines test confirmed that the proportional odds assumption was met for proficiencies such as 'Data input in spreadsheet' ($p = .935$) and 'Assignment presentation' ($p = .494$). However, there was a borderline case of 'Typing' ($p = .072$). All in all, these findings highlighted the minimal influence of predictors on the proficiencies that were assessed.

Structural equation modeling

Structural equation modelling was employed to examine relationships between variables. The results presented in [Figure 2](#) shows how different factors in the study influence each other.

Each indicator (Pr4 to Pr18) represents an observed variable associated with one of three latent variables. These are, Data Handling, Information Retrieval and Information Presentation. The standardised

Table 8. Final ordinal logistic regression model.

Proficiency	Predictor	Wald	Sig.
Typing	Gender	5.14	.02
	Geographic origin	–	–
	Prior computer studies experience	–	–
Data input in spreadsheet	Gender	–	–
	Geographic origin	4.34	.04
	Prior computer studies experience	–	–
Use of search engines	Gender	4.21	.04
	Geographic origin	–	–
	Prior computer studies experience	–	–
Effectiveness in searching for solutions	Gender	–	–
	Geographic origin	3.81	.05
	Prior computer studies experience	–	–
Assignment presentation	Gender	4.96	.03
	Geographic origin	–	–
	Prior computer studies experience	–	–
Using of animations	Gender	3.40	.05
	Geographic origin	–	–
	Prior computer studies experience	–	–

Table 9. Evaluation of the model.

Proficiency	Predictor	Pseudo R ² (nagelkerke)	Parallel line test (sig.)
Typing	Gender	.030	.072
Data input in spreadsheet	Geographic origin	.028	.935
Use of search engines	Gender	.027	.994
Effectiveness in searching for solutions	Geographic origin	.029	.265
Assignment presentation	Gender	.028	.494
Using of animations	Gender	.015	.174

factor loadings (path coefficients) shown in [Figure 2](#) indicated how strongly each observed variable contributed to its respective latent variable.

[Figure 2](#) also illustrates that for Data Handling, all loadings were above 0.60. This indicated strong contributions. Information Retrieval had, generally, strong contributions except for Pr12 which had a contribution of 0.37. Finally, Information Presentation factor loadings were all acceptable, with the lowest at 0.61. Correlations between latent variables were as follows; between Data Handling and Information Retrieval was strong (0.83). That between Data Handling and Information Presentation was moderate (0.46) and also that between Information Retrieval and Information Presentation was moderate (0.49).

Discussion

The findings of this study provide important insights into first-year undergraduate students' self-reported proficiency in EDFs and the role of gender, geographic origin, and prior computer studies experience in these proficiencies. The findings contribute to the ongoing discourse on digital literacy and higher education institutions' student preparedness for digital literacy. Guided by the Social Constructivist Theory (Vygotsky, 1978), Self-Efficacy Theory (Bandura, 1997) and Van Dijk (2020) Digital Divide framework, the findings of this study highlight how sociocultural, psychological and structural factors contribute to students' perceived proficiencies in EDFs.

While self-reported data capture perceived rather than directly measured proficiencies, the issues discussed in this study correspond with digital literacy-related observations made in higher education.

RQ1: How do students perceive their proficiency in EDFs?

The results indicate that generally, students perceive themselves as moderately proficient in EDFs. The highest confidence is in Information Retrieval (e.g. using search engines, YouTube for academic purposes) and the lowest is in Data Handling (e.g. spreadsheet-based data analysis). These findings are

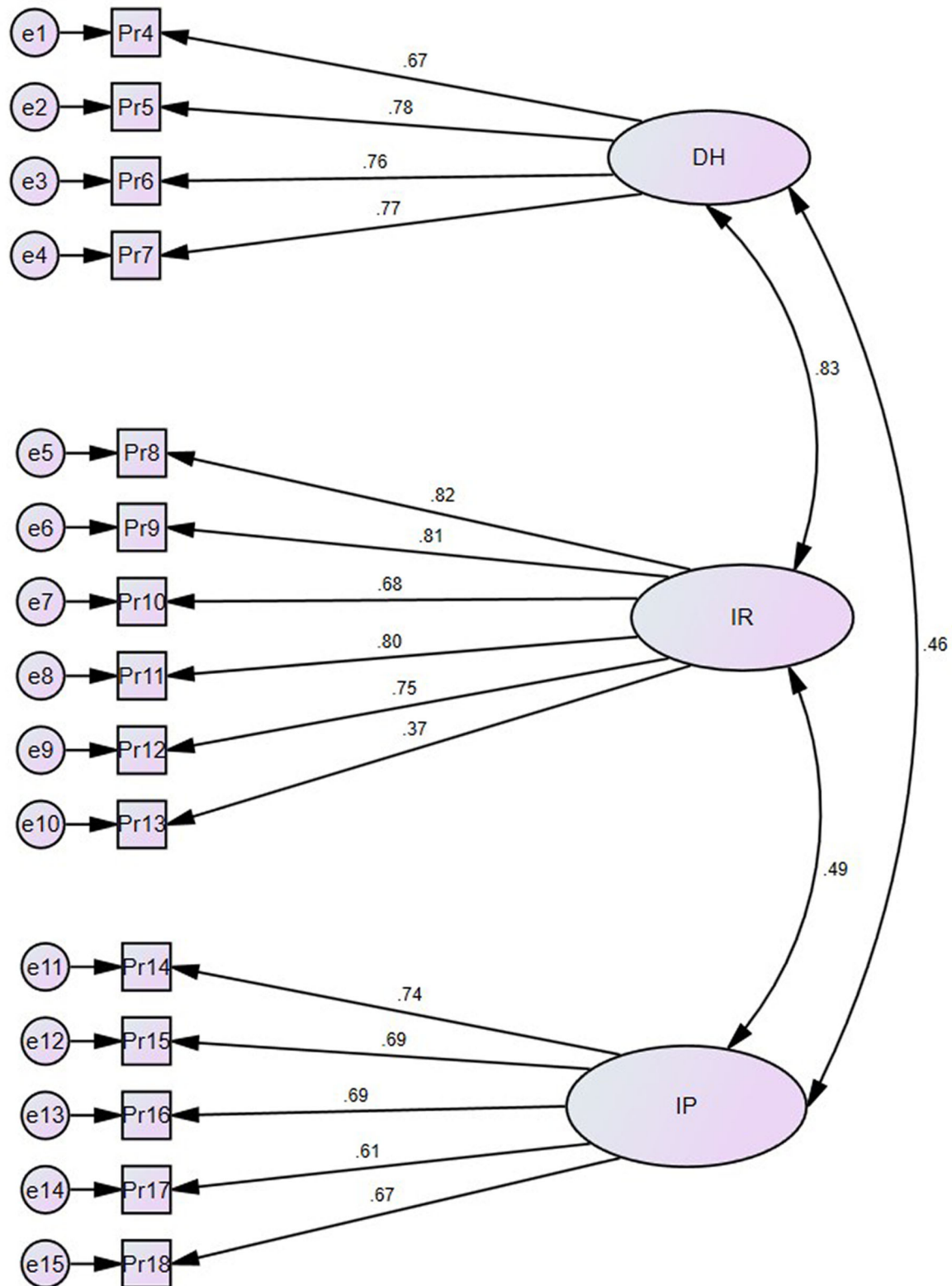


Figure 2. Structural equation modelling results. Note: DH = Data Handling, IR = Information retrieval, IP = Information Presentation, Pr4 = Typing, Pr5 = Proofreading, Pr6 = Data input in spreadsheet, Pr7 = Data analysis in spreadsheet, Pr8 = Use of search engines, Pr9 = Searching for specific keywords, Pr10 = Familiarity with search engines, Pr11 = Locating study materials, Pr12 = Using YouTube for educational information, Pr13 = Effectiveness in searching for solutions, Pr14 = Creation of visually appealing slides, Pr15 = Use of slides, Pr16 = Assignment presentation, Pr17 = Using of animations, Pr18 = Formatting of text/images.

consistent with previous research (e.g. Morgan et al., 2022), which indicates that students tend to excel in social literacy, especially those involving online communication. On-line communication is broadly categorised under the domain of Information Retrieval.

The result shows that while students are proficient at retrieving digital information, they struggle with processing and presenting it effectively. Therefore, challenges in Data Handling suggest that students may have had limited exposure to learning experiences that promote the development of these specific proficiencies. This may have contributed to the low confidence in student EDFs proficiency. Additionally, there are also structural inequalities which may be resulted in the low confidence in EDFs proficiency. The disparities observed in this study highlight the need for a focus on interventions that would strengthen student proficiencies in EDFs especially in areas such as data handling.

Effect size analysis provide further insights into the practical significance of the differences observed in the current study. While some differences in EDFs proficiency were statistically significant, many effect sizes were small. This indicates that, although disparities exist, their real-world impact may be modest. This also indicates the need for strategies that address EDFs proficiency beyond variables that were considered in this study.

RQ2: to what extent do gender, geographic origin and prior computer studies experience predict student proficiency in EDFs?

This part of the study focuses on the extent to which gender, geographic origin and prior computer studies experience predict students' proficiency in EDFs. Ordinal logistic regression was utilised to answer this research question.

Gender and EDFs proficiency

A notable finding of this study is the influence of gender on EDFs proficiency. Male students reported higher proficiency levels in several key areas that include Typing, Assignment Presentation and Use of Search Engines as compared to their female counterparts. This aligns with previous research, such as Bachmann and Hertweck (2025), which found that male students rate their digital competencies higher than females. Scholars such as Comber et al., 2021, Bachmann & Hertweck, 2025, and Campos & Scherer, 2024), have found this occurrence to stem from societal and cultural factors that influence students' attitudes towards technology. The low self-reported proficiency in EDFs by females can also be explained by the digital divide as noted by Martin et al. (2024) which also aligns with the first two levels of Van Dijk (2020) digital divide. Therefore, this pattern is consistent with Van Dijk's framework, where sociocultural norms perpetuate inequalities in communities.

However, the study's ordinal regression models revealed that gender alone has limited explanatory power in predicting overall EDFs proficiency. Instead, its predictive influence was confined to specific areas, such as assignment presentation and the use of search engines. This highlights the need to consider other factors such as ICT resources, university facilities and student engagement in order to understand these disparities in EDFs proficiency among first-year undergraduate students in Zambia.

Geographic origin (rural/urban) and EDFs proficiency

The findings reveal a significant rural-urban disparity in self-reported EDFs proficiency, with rural students rating their proficiency lower than their urban counterparts. This finding is consistent with studies by Lembani et al. (2020), and Aruleba and Jere (2022), which highlight the digital divide between urban and rural students due to differences in access to ICT resources. The finding also aligns with Zhao, Sánchez Gómez et al. (2021), who observed urban students' higher self-reported digital proficiencies. Rural students' lower self-reported proficiency underscores persistent barriers are shown by unequal access to ICT infrastructure (Van Dijk, 2020) which may lead to uneven student proficiencies in EDFs. This result also reflects compounded challenges that are rooted in student geographic origins. Therefore, this pattern is consistent with Van Dijk's framework, where access perpetuate inequalities in communities.

Using ordinal regression models, geographic origin emerged as a predictor of EDFs proficiency, though its predictive power was confined to specific areas such as Data input in spreadsheet and Effectiveness in searching for solutions through digital means. While the predictive power was confined to these specific areas, the finding nevertheless shows the role of geographic origin to the urban-rural digital divide on student EDFs proficiency.

Prior computer studies experience and EDFs proficiency

The results reveals that overall, students with prior computer studies experience have a higher proficiency compared to those without such an experience. This is in line with Zhao, Sánchez Gómez et al. (2021) findings that student with prior computer studies experience report higher in self-assessed proficiency than those without prior experience. Surprisingly, prior exposure to computer studies did not significantly predict self-reported EDFs proficiency. This divergence may reflect inadequacies in secondary school ICT education. This could be explained by findings from researchers such as Konayuma et al. (2023) who argued that many primary and secondary schools in Zambia lack adequate ICT infrastructure. This limit institution's capacity to promote meaningful EDFs proficiency in their students.

Consequently, even students with secondary school ICT experience enter university without EDFs proficiency required in higher education institutions. These finding diverges from Senkbeil's (2022) assertion that prior knowledge is the most critical predictor of ICT skill acquisition. Therefore, these findings raise concerns about the effectiveness of secondary school ICT curricula in preparing students for digital demands in higher education.

RQ3: How do the underlying key factors that characterise students' perceived proficiency in EDFs relate to each other?

The results from Structural Equation Modelling reveals strong correlations between Data Handling and Information Retrieval. This suggests that students who reported that they were proficient in Data Handling were also likely to report proficiency in Information Retrieval. This aligns with the findings of Zhao, Sánchez Gómez et al. (2021), who showed that students with higher proficiency in data management also believed that they were proficiency in retrieving digital information.

However, Information Presentation appears to be a more distinct domain as shown by the relationship in Figure 2. Information Presentation has weaker correlations with the other two key factors (Data Handling and Information Retrieval). This scenario shows the need for additional pedagogical focus that can help bridge this gap between digital content acquisition (e.g. Information retrieval) and effective presentation. Therefore, this finding highlights the need to strengthening EDFs acquisitions in these areas in order to enhance students' information presentation skills so that they can translate retrieved information into well-structured academic work.

Conclusion

This study contributes to the growing body of literature on digital literacy by examining first-year undergraduate students' self-reported proficiency in EDFs in the Zambian higher education context. Specifically, the study showed the influence of gender, geographic origin and prior computer studies experience on students' EDFs proficiency.

The findings reveal that students perceive themselves as moderately proficient in EDFs, with the highest confidence in Information Retrieval, particularly in using search engines and YouTube for academic purposes. Data Handling emerged the lowest. This suggest a gap in students' ability to manage and analyse retrieved data effectively. In addition, gender and geographic origin were found to be significant predictors of EDFs proficiency. Male students and those from urban areas reported higher competencies in EDFs compared to their female and rural counterparts.

Further analysis of the relationships among key factors (Data Handling, Information Retrieval and Information Presentation) revealed a strong correlation between Data Handling and Information

Retrieval. This suggests that students who perceived themselves to be proficient in retrieving digital content were also better in managing digital content. However, Information Presentation exhibited weaker correlations with the other two key factors. This indicates a relative disconnect between students' ability to acquire information and their capacity to effectively present it in academic contexts. Therefore, these findings illustrate the need to promote proficiency in EDFs by including a focus on the enhancement of student ability to analyse and present digital information effectively. Addressing issues such as gender inequalities, urban-rural digital divide, and short comings in secondary school ICT curricula can contribute in supporting student proficiencies in EDFs.

Limitations

One limitation of the study is the reliance on self-reported information, which may lead to biases such as overestimation or underestimation of proficiencies in EDFs. This may be due to the Dunning-Kruger effect (Yang et al., 2024). Another limitation is the study's focus on only one university. This can limit the generalisability of findings to other universities which have different infrastructure and student demographics.

Recommendations

To address the identified gaps and improve on future studies in EDFs, the following recommendations are proposed:

1. The study has not made it certain how self-reported proficiency align with actual student proficiency in EDFs. Future study should include objective assessment of EDFs through tools such as competency-based assessments in order to determine how self-reported proficiency align with actual student proficiency in EDFs. Triangulation of data can help identify discrepancies between student perceived and actual proficiencies. Inclusion of interviews can also help strengthen the study as it can assist the researcher to have an in-depth understanding of student perceived proficiency in EDFs.
2. A broader study involving multiple universities in different provinces should be conducted in order to provide a more comprehensive insight into student proficiency in EDFs. A cross-institutional study could involve both public and private universities so that it could cut across various context.
3. The current study explored the influence of gender, geographic origin and prior computer studies experience. Future research could consider additional variables such as access to technology when outside the school and curriculum integration of EDFs. This will help develop a more holistic understanding of factors contributing to student EDFs proficiency.
4. The university should refine the ICT curriculum. This can be done by strengthening EDFs in university curricula with an emphasis on strengthening challenging areas such as spreadsheet applications and data analysis which reflected low student self-reported proficiency. Strengthening EDFs, especially for first-year students can promote digital autonomy and equip learners with skills essential for their independent learning during their university studies.

Ethical approval

The ethical approval for this study was granted by the Directorate of Research and Innovation at the university where the study was conducted, the unit responsible for ethical oversight.

Informed consent

Before responding to the questionnaire, the research informed the students about the purpose of the research. Additionally, the first section of the questionnaire provided a detailed explanation of the survey's objectives. Participation was entirely voluntary.

Disclaimer - artificial intelligence (AI)

The manuscript was written entirely by the researcher. Generative Artificial Intelligence (AI) tool ChatGPT (version GPT-4, OpenAI) was only used at some points to enhance the clarity, grammar and to assist in the conversion of references to APA style.

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