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Readiness for Smart Learning Transformation in Tanzanian Higher Learning Institutions: A Case Study of EASTC and IFM

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KEYWORDS

smart learning, digital tools, Tanzania, higher learning, smart classrooms

ABSTRACT

The transition toward smart learning is gaining momentum worldwide, including in Tanzania, where higher learning institutions are increasingly moving from conventional teaching approaches to technology-enhanced learning environments. This study assessed the readiness of selected higher learning institutions in Tanzania for smart learning transformation. A cross-sectional research design employing a quantitative approach was adopted. Using stratified sampling techniques, 375 students were selected, of whom 349 successfully completed structured online questionnaires administered through Google Forms. The collected data were analyzed using IBM SPSS Statistics Version 20. The findings revealed that although internet connectivity is generally available across the institutions, its quality and reliability remain inadequate. A positive correlation ($r = 0.300$) was observed between internet reliability and the frequency of students' use of digital academic resources. The study also established the existence of smart classrooms within the institutions; however, some of these facilities were found to be non-functional. Furthermore, the results indicated that most students possessed a high level of proficiency in using smart learning technologies, with a statistically significant relationship identified between gender and the use of smart learning tools ($\rho = 0.172$, $p < 0.001$). Despite these positive indicators, the integration of digital library services into smart learning platforms remains incomplete. Overall, the study concludes that EASTC and IFM demonstrate a considerable level of readiness for the adoption of smart learning. Nevertheless, several critical areas require improvement

to ensure successful implementation. The study recommends that institutions invest in strengthening their technological infrastructure, particularly by providing stable, reliable, and high-performance internet connectivity. In addition, higher learning institutions should expand the availability of fully functional smart classrooms and prioritize the comprehensive integration of digital library services into smart learning platforms to facilitate flexible, seamless, and efficient access to academic resources.

1.0 Introduction

Higher learning institutions worldwide have been at the forefront of integrating technologies to simplify teaching and learning as well as the delivery of academic services in line with the Fourth Industrial Revolution (4IR). However, the outbreak of the COVID-19 pandemic significantly accelerated the adoption and use of these technologies. During this period, higher learning institutions were compelled to adopt more advanced technologies such as smart devices, virtual reality, augmented reality, Moodle, blockchain, and other emerging digital tools (Kanyika et al., 2025). As physical contact was strongly discouraged across almost all sectors, the academic sector especially in developed countries have shifted from traditional face-to-face way of learning to more flexible and technology-enabled ways of learning. Consequently, Moodle emerged as a primary platform facilitating distance and online learning (Gambo & Shakir, 2022). Interestingly, Moodle has remained the primary mode of learning in some higher learning institutions, while in others it is regarded as an alternative approach adopted because of its numerous advantages over traditional learning methods (Almaiah et al., 2020). Effective and appropriate implementation of Moodle and other modern learning technologies requires both lecturers and students to possess adequate digital literacy skills (Kanyika et al., 2024a).

To date, a large number of higher learning institutions, particularly in developed countries, have made significant progress by integrating modern technologies across academic services and pedagogy, ultimately transforming themselves into smart universities (Hashim, 2018; Kanyika & Sadykova, 2024). These institutions employ a range of advanced technologies, including augmented and virtual reality, 3D printing, cloud services, the Internet of Things (IoT), RFID technology, blockchain technology, and learning management systems such as Moodle (Rico-Bautista et al., 2019). Essentially, smart universities incorporate intelligent hardware and software systems, advanced computer systems applications, academic analytics, and other branches of computer engineering. Consequently, teaching and learning environments within these institutions are characterized as smart classrooms, supported by smart pedagogy (Adipat, 2024). Similar to traditional universities that operate within physical campuses, smart universities are distinguished by the incorporation of environmental intelligence across their campuses (Bahja et al., 2021). However, the growing number of universities transitioning to smart university models in

developed countries can be attributed not only to positive perceptions toward digitization but also to the strong financial capacity available to support such transformations (Kanyika et al., 2024b).

The shift from traditional learning methods to smart learning in higher learning institutions within developing countries is gaining momentum. Academic institutions are increasingly integrating modern technologies to enhance teaching and learning processes. Technologies such as Moodle, smart devices, and intelligent hardware and software systems have become common across many higher learning institutions in developing countries (Farrah & Al-Bakry, 2020). Although technologies such as the Internet of Things (IoT) and Moodle serve as alternatives to traditional teaching and learning approaches, they have demonstrated increased efficiency and effectiveness by enabling smart classrooms and smart campuses. Furthermore, many higher learning institutions have adopted advanced technologies such as artificial intelligence and machine learning for decision-making and for predicting student dropouts, thereby contributing to improvements in the overall quality of education (Bahja et al., 2021).

Tanzania is no exception to this global trend. Like many higher learning institutions in developing countries, Tanzanian institutions are increasingly transitioning toward smart learning as new technologies such as artificial intelligence related tools like chatbots, machine learning applications, and learning management systems like Moodle are gradually being adopted. Despite the growing implementation of these technologies, it remains unclear whether higher learning institutions in Tanzania are ready to full transform into smart learning environment through possessing adequate digital technologies and possession of adequate digital literacy among lecturers and students. This study therefore aims to address this gap by assessing the readiness for smart learning transformation in Tanzanian higher learning institutions using the Eastern Africa Statistical Training Centre (EASTC) and the Institute of Finance Management (IFM) as case studies.

1.1 Main Objective

The main objective of this study is to assess the readiness for smart learning transformation in Tanzanian higher learning institutions in Tanzania, a case of EASTC and IFM.

1.1.1 Specific Objectives

Specifically, the study aims;

i. To assess the technological infrastructure available at EASTC and IFM
ii. To examine the level of digital literacy skills among students at EASTC and IFM
iii. To examine how information resources and digital content are integrated with new technologies to support smart learning at EASTC and IFM

2.0 Literature Review

The transition to smart universities has been driven by numerous internal and external factors. One of the most significant factors accelerating this transformation is the rapid increase in student enrolment relative to the number of lecturers, coupled with limited campus space to accommodate large student populations. As a result, higher learning institutions have begun to explore alternative approaches based on digital learning tools and educational technologies (Yu et al., 2021). The adoption of these technologies has led to the development of smart classrooms and smart learning environments (Uskov et al., 2018). According to Farrah and Al-Bakry (2020), learning experiences within smart classrooms and smart environments significantly enhance student performance by increasing curiosity and engagement. Furthermore, the integration of advanced technologies such as virtual reality promotes critical thinking and sustained student involvement in the learning process.

Students in both developed and developing countries today exhibit diverse learning styles and expectations. Consequently, higher learning institutions are required to establish appropriate technological infrastructures that can effectively accommodate these varying needs (Hashim, 2018). Traditionally, student identification in higher learning institutions relied on physical identity cards; however, in smart learning environments, such systems have increasingly been replaced by facial recognition technologies (Polin et al., 2023). In addition, technologies such as Learning Management Systems (LMS) enable students to access learning materials, submit assignments, and communicate virtually with peers and instructors (Huisman & Huang, 2022). Due to intense competition among higher learning institutions to attract prospective students, some universities have adopted emerging technologies such as augmented reality (AR) and virtual reality (VR). These technologies allow prospective students to virtually explore campus environments including classrooms, libraries, and laboratories through 360-degree virtual tours (Uskov et al., 2018). Furthermore, institutions with large campuses have implemented live mapping systems to assist students in navigating campus facilities and becoming familiar with their surroundings (Alhaddad, 2019). According to Huisman and Huang (2022), by 2030 artificial intelligence is expected to significantly transform the learning process by promoting smart learning across most higher learning institutions worldwide. Therefore, universities are compelled to adopt appropriate and up-to-date technological infrastructures to remain relevant and competitive.

Learning in a smart environment requires both students and lecturers to possess adequate skills in using and interacting with digital technologies. A study by Gambo and Shakir (2022) found that the majority of students at Adamawa State University, Mubi (ADSU) in Nigeria have high levels of proficiency in using smart devices, which effectively support their learning processes. These devices were reported to enhance both efficiency and effectiveness in their studies. Similarly, Kanyika et al. (2024a) revealed that students in Kazakhstan generally demonstrate moderate skills in utilizing various emerging technologies for academic purposes. Despite this moderate level of competence, the use of these technologies was found to improve students' academic performance compared to traditional learning approaches. Furthermore, Harati et al. (2021) reported that

Bachelor's degree students in Chemical Engineering at a Southwestern university in the United States possess appropriate technological skills that enable effective interaction with digital tools. These skills support self-regulated learning by allowing students to learn at their own pace, in contrast to traditional learning models that require all students to be physically present in one location. In addition, Naujoks et al. (2021) found that a large proportion of students in Germany have high levels of digital skills, which significantly facilitate their academic studies.

Access to information is a fundamental component of the learning process. In traditional learning environments, students physically visit libraries to obtain information; however, in smart learning environments, students can access library resources virtually through the use of advanced digital technologies (Naujoks et al., 2021). For effective implementation of smart learning, libraries must be integrated with digital technologies that support online education. For instance, library resources and digital content should be integrated with Learning Management Systems (LMS) such as Moodle, which is widely used to facilitate smart classrooms (Mursid et al., 2022). Furthermore, emerging digital technologies, such as blockchain, have been reported to enhance access to information in smart learning environments (Lagstedt et al., 2020). This technology has been observed to outperform traditional systems that have long been used in conventional learning environments (Kanyika et al., 2025).

2.1 Theoretical Framework

This study is guided by the 4T Model, as illustrated in Figure 1, which is adopted from Potapchuk et al. (2022). The model has been widely applied in studies examining the transition to smart universities and the adoption of new digital technologies to support smart learning environments. The 4T Model comprises four interrelated dimensions namely Technologies, Tactics, Talents, and Traditions. ***Technologies*** refer to the integration of digital tools, provision of open access to educational content, automation of administrative processes, and the facilitation of effective feedback between teachers and students. ***Tactics*** focus on a student-centered organizational and operational framework, supported by appropriate infrastructure and strategic approaches to university management. ***Talents*** emphasize the development of competent teachers with strong professional skills, as well as smart students capable of continuous growth and advancement in their future professions. ***Traditions*** highlight the need to preserve and adapt valuable institutional traditions to align with contemporary demands and ensure sustainable future development.

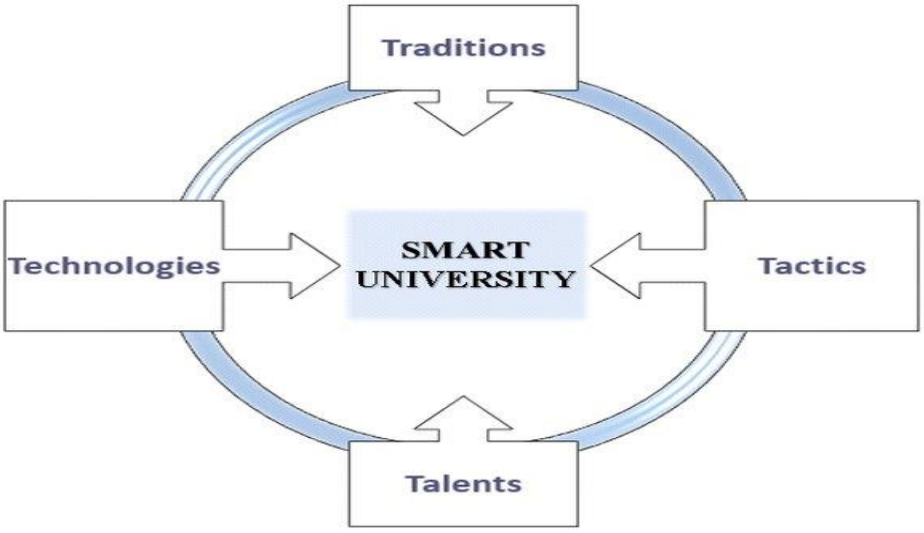

Figure 1: Adopted 4T Model
Source: Potapchuk et al. (2022)

Based on this model, higher learning institutions in both developed and developing countries are required to shift from traditional modes of learning to smart learning approaches. This transformation is driven by increasing student demands as well as the rapid emergence of advanced digital technologies. However, in the process of transitioning to a smart learning environment, higher learning institutions must consider the four key dimensions of the 4T model. *Technologies* are a fundamental component, as institutions need to adopt technologies that align with users' needs and can be effectively integrated with existing systems and software. Moreover, these technologies should enable easy and ubiquitous access to information, since smart learning environments allow students to access learning resources anytime and anywhere. *Tactics* involve the development of appropriate technological infrastructure and the implementation of student-centered strategic approaches that facilitate meaningful interaction and engagement within an intelligent learning environment. *Talent* is another critical component of the model, emphasizing that as higher learning institutions transition to smart learning environments, both teachers and students must possess adequate digital competencies to effectively engage within intelligent learning systems. In particular, teachers are expected to have strong professional and pedagogical skills that enable them to support and develop students' competencies in their respective professional fields. *Traditions,* the final component, underscore the importance of institutional policies to guide the transformation toward smart learning environments. Higher learning institutions should develop clear policies that not only support digital transformation but also preserve and adapt valuable institutional traditions, ensuring alignment with emerging educational demands and promoting sustainable future development.

3.0 Methodology

3.1 Research Instruments

This study employed a cross-sectional research design to collect data from the target population at a single point in time, making it a cost-effective and efficient approach. The design is well suited for descriptive analysis, as it allows researchers to determine the prevalence of specific characteristics or outcomes and to examine multiple variables simultaneously in order to identify relationships and correlations (Oliveira, 2023). Quantitative research approach was adopted, and data triangulation from multiple sources was used to enhance the reliability and generalizability of the study findings (Creswell, 2012). The study population comprised students from the Eastern Africa Statistical Training Centre and the Institute of Finance Management. These institutions were purposively selected because they are among the few higher learning institutions in Tanzania that have implemented and actively utilize emerging technologies to support smart learning. A stratified sampling technique was employed to ensure adequate representation from each institution, thereby minimizing sampling bias and enhancing the generalizability of the results.

3.2 Research Participants and Sampling Process

The population in this study include 2300 students from the Eastern Africa Statistical Training Centre (EASTC prospectus, 2025) and 12,700 students from the Institute of Finance Management (IFM prospectus, 2025), making a total population of 15,000 students at all academic levels (certificate, diploma, bachelor's degree, and master's degree). Students from all levels were included because, at various stages of their studies, they interact with digital technologies that support a smart learning. The sample size for the study was determined using the formula proposed by Krejcie and Morgan (1970).

$$n = \frac{X^2 N p q}{d^2 (N-1) + X^2 p q}$$

Where:

- X^2= table value of Chi-square for 1 degree of freedom at the desired confidence level (3.841)
- *n*= required sample size
- *d*= degree of accuracy expressed as proportion (0.05)
- *N*= population size

$$n = \frac{3.841\ x\ 15{,}000\ x\ 0.25}{0.0025\ (14{,}999) + 3.841\ x\ 0.25}$$

$$n = \frac{14{,}401}{38.46}$$

Sample size, n≈375

A stratified sampling technique was employed to select 375 students who participated in the study. The target population was first divided into strata based on academic level to ensure proportional representation across all levels. This approach guaranteed that each academic category was adequately represented in the sample.

Apart from being enrolled as a student at EASTC or IFM at any academic level (certificate, diploma, bachelor's, or master's), no additional inclusion criteria were applied. This is because it was assumed that students at all stages of study interact with digital technologies that support smart learning, and therefore possess relevant knowledge and experience related to the topic under investigation.

3.3 Data Collection Procedure

Primary data for this study were collected using structured online questionnaires consisting of closed-ended questions. A total of 375 questionnaires were distributed to selected respondents via Google Forms through their email addresses, of which 349 were completed and returned, resulting in a response rate of 93%.

To ensure the reliability of the data collection instrument, a pilot study was conducted prior to the main study. The structured online questionnaire was administered to 15 randomly selected students who were not part of the final sample. This pilot test aimed to assess whether the questionnaire adequately captured the required information in line with the study objectives, and the results confirmed that the instrument was reliable. Furthermore, the internal consistency of the research instrument was evaluated using Cronbach's Alpha reliability coefficient. Before distributing the questionnaires, informed consent was obtained from all prospective respondents. Participants were also informed of their right to withdraw from the study at any stage without any consequences. On top of that, for ethical purposes, the permission to conduct the study from the two institutions was obtained from the relevant authorities.

In addition, secondary data were collected through a comprehensive literature review, including academic journal articles, books, magazines, theses, and reports. According to Welch et al. (2022), these sources provide essential contextual background, theoretical foundations, and comparative insights that support the analysis of primary data.

3.4 Data Analysis

Data analysis in this study was conducted using quantitative techniques. Data collected through an online structured questionnaire were analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistics, including frequencies, percentages, mean values, and standard deviations, were computed, and the results were presented using tables and charts. To assess technological infrastructure in higher learning institutions, respondents were asked to rate the reliability of internet connectivity on a four-point scale: 1 = very reliable, 2 = reliable, 3 = slightly reliable, and 4 = not reliable. Spearman's rank-order correlation analysis was

employed to determine whether a statistically significant relationship exists between the reliability of internet connectivity and the use of digital academic resources. To evaluate the availability and functionality of smart classrooms, students were asked to indicate their status using the following scale: 1 = very available and fully functional, 2 = available and mostly functional, 3 = available and poorly functional, and 4 = not available.

The level of digital literacy skills among students was measured by assessing their confidence in using smart learning tools through a five-point Likert scale: 1 = very confident, 2 = confident, 3 = moderately confident, 4 = slightly confident, and 5 = not confident at all. Spearman's rank-order correlation analysis was further conducted to examine the relationship between demographic characteristics and students' confidence in using smart learning tools, and to determine the extent of this relationship. In analyzing the integration of information resources with digital technologies, students rated the level of integration on a Likert scale: 1 = fully integrated, 2 = moderately integrated, 3 = minimally integrated, 4 = not integrated at all, and 5 = I do not know. Finally, to measure accessibility to digital library resources, students were asked to indicate their level of access using a five-point scale: 1 = very adequate access, 2 = adequate access, 3 = somewhat adequate access, 4 = inadequate access and 5 = no access at all.

4.0 Findings and Discussion

4.1 Demographic Characteristics

In this study, a total of 349 respondents participated. The demographic variables analyzed included gender, age group, and level of education. These characteristics are crucial in understanding the context in which technological infrastructure, digital literacy, and integration of digital resources operate within higher learning institutions in Tanzania.

Table 1: Demographic Characteristics of the Respondents

Variables	Frequency	Percentage
Gender		
Male	193	55
Female	156	45
Total	***349***	***100***
Age group		
20-29 years	342	98
30-39 years	3	1
40-49 years	3	1
50 and above years	1	0
Total	***349***	***100***
Level of education		
Bachelor degree	231	66
Master's degree	32	9
Non-degree	86	25

Total	***349***	***100***

Source: *Field Data (2026)*

Findings of the study show that 193 respondents (55%) were male while 156 respondents (45%) were female. This indicates a relatively balanced gender representation with a slightly higher proportion of male participants. More so, the results indicate that the majority of respondents, 342 (98%), were in the 20–29 years age group, while 3 respondents (1%) were between 30–39 years and 40–49 years consecutively. This distribution shows that the sample is overwhelmingly composed of young respondents. In this case, the study reveals limited age diversity, which might constrain the generalizability of the findings to older populations. On the other hand, the findings show that 231 respondents (66%) are studying bachelor's degree level, 32 respondents (9%) were studying non-degree courses, and 86 respondents (25%) were studying master's degree courses. Overall, the results indicate that the study sample is heavily skewed toward students who are studying undergraduate courses, with comparatively limited representation from students who are studying postgraduate courses.

4.2 Technological Infrastructures Available at EASTC and IFM

The study sought to analyze the technological infrastructures found in the Higher Learning Institutions in Tanzania particularly EASTC and IFM.

4.2.1 Reliability of Internet Connectivity

Students were asked to indicate the level of reliability of internet connectivity in their institutions as seen in Figure 2.

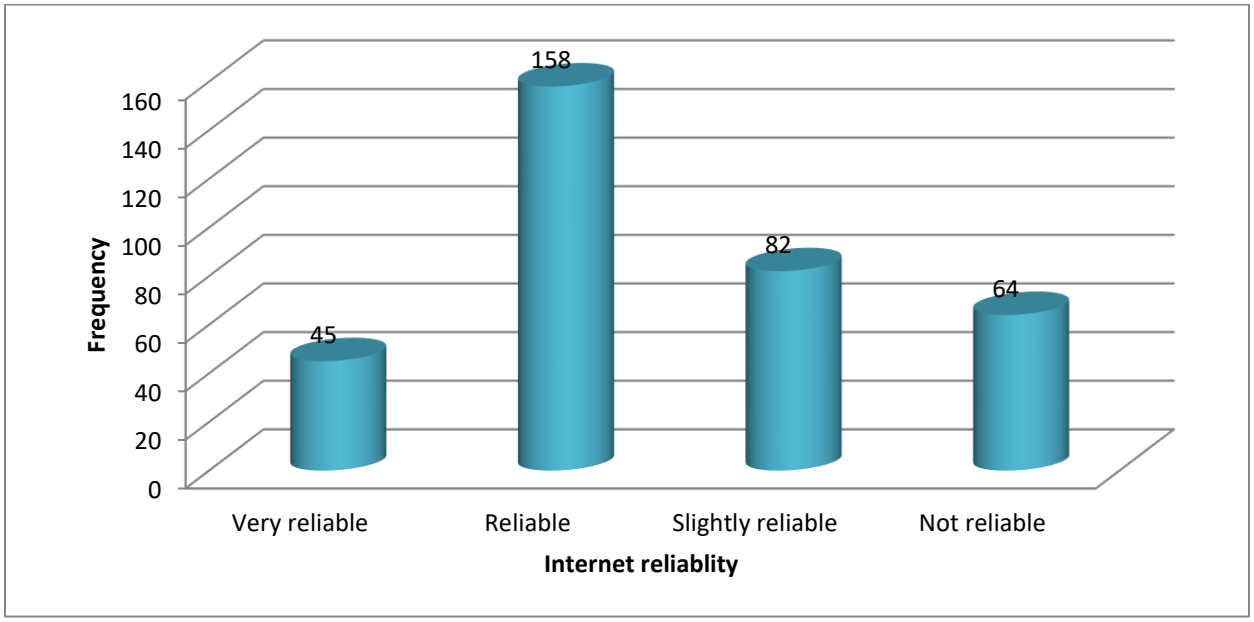

Figure 2: Level of Reliability of Internet Connectivity

Source: *Field Data (2026)*

A total of 158 respondents (45.3%), as illustrated in Figure 2, perceived internet connectivity as generally reliable. In contrast, a smaller proportion, 45 respondents (12.9%), rated the internet as very reliable. This shows that, when these two groups are combined, the findings indicate that nearly half of the participants report a positive experience with internet stability and performance. However, the results also reveal a notable level of dissatisfaction among respondents regarding internet connectivity. Findings show that, 82 respondents (23.50%) described that the internet connectivity as only slightly reliable; suggesting inconsistent or moderate performance. Additionally, 64 respondents (18.3%) rated internet connectivity as not reliable, indicating significant concerns regarding its dependability. In general, the findings suggest that while internet services are adequate for a substantial proportion of users, considerable challenges remain in terms of consistency and quality. This underscores the need for improvements in internet infrastructure and service delivery.

Technological infrastructure is a fundamental consideration in the implementation of a smart learning environment, with reliable internet connectivity being one of the essential requirements (Hashim, 2018). The findings of this study reveal that internet connectivity is generally perceived as reliable. However, a notable proportion of respondents reported concerns regarding its reliability, suggesting that some users are dissatisfied with its performance. These results highlight the need for management to undertake significant improvements in both the availability and performance of internet services. Without consistent and high-performing connectivity, the effective functioning of a smart learning environment would be compromised. Furthermore, these findings are consistent with those of Huisman and Huang (2022), who similarly observed that while the majority of respondents considered internet connectivity to be reliable, a minority expressed concerns about its reliability. Their study also emphasized the importance of proactive management efforts to ensure continuous and dependable internet connectivity to support a seamless smart learning environment.

More so, the Spearman's rank-order correlation was conducted to assess the relationship between the reliability of internet connectivity and the use of digital academic resources. The results are presented in Table 2.

Table 2: Relationship between Internet Reliability and the Usage of Digital Resources

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
Internet reliability	2.47	.936	349
Frequency in using digital academic resources	2.20	.906	349

Correlations

		Internet reliability	Frequency in using digital academic resources
Internet reliability	Correlation Coefficient	1.000	0.300**
	Sig. (2-tailed)	-	< .001
	N	349	349
Frequency in using digital academic resources	Correlation Coefficient	0.300**	1.000
	Sig. (2-tailed)	< .001	-
	N	349	349

**. Correlation is significant at the 0.01 level (2-tailed).

Source: *SPSS Output*

The mean score of 2.47 for internet reliability as shown in Table 2 indicates that, for most users, internet connectivity is inconsistent. Similarly, the mean score of 2.20 for the frequency of using digital academic resources suggests that respondents do not regularly engage with these resources. These mean scores imply a direct statistical relationship, where unreliable internet connectivity is associated with lower usage of digital academic resources, suggesting that poor connectivity may limit access and engagement.

Furthermore, the Spearman correlation coefficient ($\rho = 0.300$) indicates a positive but moderate relationship between internet reliability and the frequency of using digital academic resources. This suggests that as internet reliability improves, so does the usage of digital academic resources. The p-value ($p < .001$) is far below the 0.05 threshold, confirming that this relationship is statistically significant. Therefore, enhanced internet reliability is linked to the frequency of using digital academic resources.

One of the primary motivations for higher learning institutions to transition to smart learning environments is to enhance the quality of education (Bahja et al., 2021). In this context, any factor that hinders the effective use of digital academic resources which is intended to complement or replace printed materials, may negatively impact educational quality. The findings of this study confirm a statistically significant relationship between internet connectivity and the use of digital academic resources. This implies that institutional management must recognize that investments in digital resources can only yield optimal benefits if supported by reliable and high-performing internet connectivity. Failure to ensure consistent connectivity may result in underutilization of these resources, thereby leading to inefficient use of limited financial investments. These results are consistent with the findings of Harati et al. (2021), who also reported a direct relationship between internet connectivity and the usage of digital academic resources. Their study demonstrated that reliable and high-quality internet connectivity enhances the use of digital academic resources, whereas poor connectivity leads to reduced utilization.

4.4.2 Availability and Functioning of Smart Classrooms

Respondents were asked to indicate whether smart classrooms including tools such as projectors, interactive boards, LMS-integrated systems, are available and functioning. The findings are summarized in Table 3.

Table 3: Availability and Functioning of Smart Classrooms

		Frequency	Percent	Cumulative Percent
Valid	Very available and fully functional	97	27.8	27.8
	Available and mostly functional	175	50.1	77.9
	Available but poorly functional	63	18.1	96.0
	Not reliable	14	4.0	100.0
	Total	***349***	***100.0***	

Source: *Field Data (2026)*

A substantial number of respondents (175; 50.1%), representing more than half of all participants, reported that classrooms are equipped with technological tools such as projectors, interactive boards, and LMS-integrated systems that support smart learning and are fully operational. Conversely, 63 respondents (18.1%) indicated that while smart classrooms are available, they do not function effectively, highlighting usability challenges that require attention and improvement. Interestingly, a smaller group of respondents (14; 4%) noted that smart classrooms are unreliable or not in use, suggesting that certain classrooms may need upgrades, enhanced maintenance, or additional training to optimize their functionality.

The presence of smart classrooms is one aspect, but their functionality is equally critical. According to Adipat (2024), while smart classrooms are essential in a smart learning environment, they must be fully operational; mere availability without functionality renders them ineffective. The findings of this study reveal mixed responses: some participants reported that smart classrooms are both available and functional, whereas others indicated that they are either available but not functional or entirely absent. This suggests that, although institutions aspire to transition fully to smart learning environments, significant improvements are still required to ensure that smart classrooms are both accessible and operational. According to 4T model used in this study, the mere presence of facilities such as projectors or smart boards, without proper functionality, offers little value. These findings contrast with those of Polin et al. (2023), who reported that all smart classrooms in their study were both available and functional, thereby facilitating a more seamless and effective smart learning experience.

4.3 Level of Digital Literacy Skills among Students at EASTC and IFM

The study sought to examine the level of digital literacy among students in higher learning institutions in Tanzania specifically at EASTC and IFM.

4.3.1 Confidence in Using Smart Learning Tools

Students were asked to report their level of confidence in using smart learning tools. The study's findings are summarized in Figure 3.

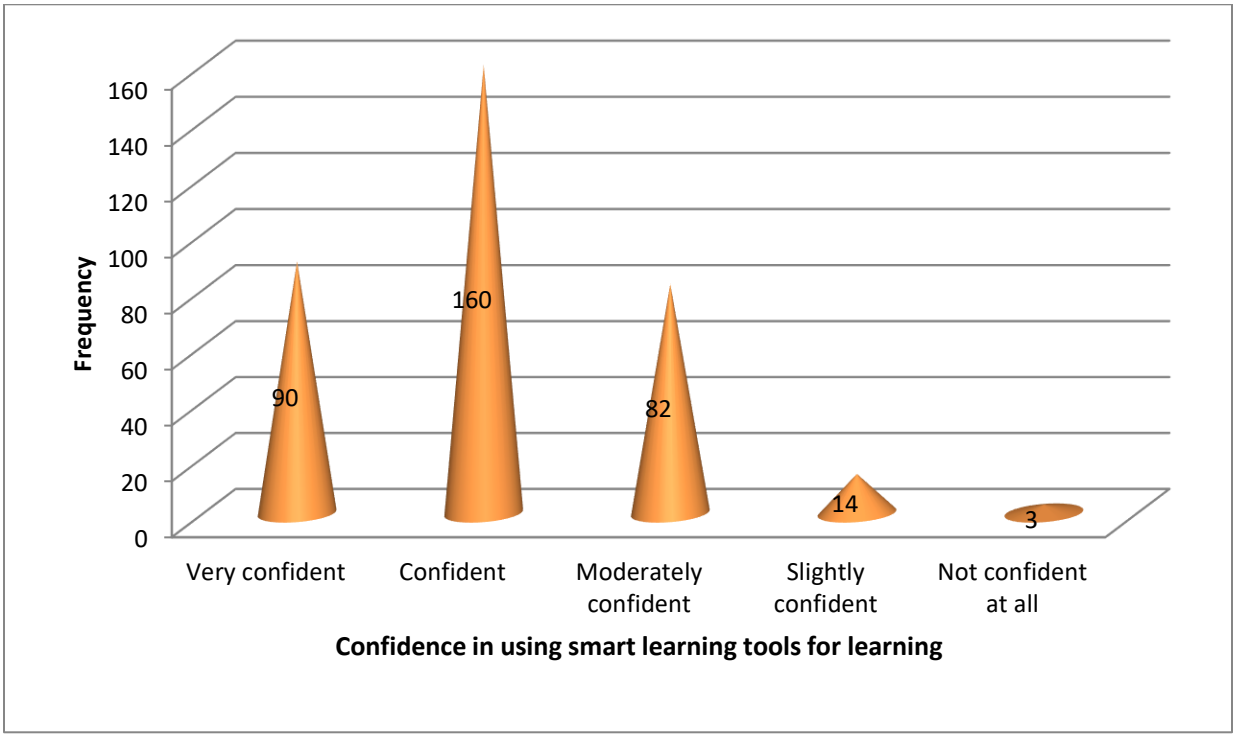

Figure 3: Confidence Level in Using Smart Learning Tools
Source: *Field Data (2026)*

Based on the results in Figure 3, the majority of respondents (160; 45.8% and 90; 25.8% respectively) indicate that they are confident and comfortable in using smart learning tools for learning. In contrast, 82 (23.5%) respondents feel that they have moderate confidence in using smart learning tools, whereas, 14 (4%) respondents reported having only slight confidence in using smart learning tools. However, 3 (0.9%) respondents despite being few in number but they have clearly indicate that they have no confidence at all in using smart learning tools for learning. Generally, despite the fact that the majority of respondents shows that they are confident and confortable in using smart learning tools, but a noticeable amount also indicate that they are not well confident which suggests that some users may need additional support or training to effectively utilize these smart learning tools.

Digital literacy plays a critical role in a smart learning environment, as it enables students to effectively engage with digital technologies. For such an environment to function optimally, users must possess the necessary skills to navigate and utilize these intelligent systems. The results indicate that the majority of respondents have a high level of proficiency in using smart learning tools, while only a small proportion possess limited skills, and a very minimal number lack such skills altogether. The high level of proficiency in using smart learning tools reported by most

respondents may be partly attributed to the youthful nature of the sample. Being members of a generation that has grown up in a technology-rich environment, respondents in the 20–29 age groups are more likely to possess the skills and confidence required to interact with digital learning technologies. This demographic characteristic may explain why only a small proportion reported limited digital literacy skills and an even smaller number lacked such skills altogether.

However, these findings suggest that although most respondents are adequately equipped with the required competencies, management should still pay attention to the smaller group with limited or no skills. This is important because the primary goal of transitioning to smart learning is to enhance educational quality and improve performance. The presence of even a small group lacking the necessary skills may slow down the achievement of these expected outcomes. These results are consistent with the findings of Naujoks et al. (2021), Harati et al. (2021), and Gambo and Shakir (2022), who similarly reported that the majority of respondents in their studies demonstrated strong proficiency in using digital and smart learning tools, enabling them to effectively benefit from smart learning environments.

Furthermore, Spearman's rank-order correlation was conducted to assess the relationship between gender, level of education, and confidence in using smart learning tools as summarized in Table 4.

Table 4: Relationship between Gender, Education Level and Confidence in Using Smart Learning Tools

		Correlations		
		Confidence in using smart learning tools for teaching or learning	Gender	Level of education
Confidence in using smart learning tools for teaching or learning	Spearman rho (ρ)	1.000	0.172	-0.010
	Sig. (2-tailed)	-	0. 001**	0.851
	N	349	349	349
Gender	Spearman rho (ρ)	0.172	1	0.018
	Sig. (2-tailed)	0. 001**	-	0.732
	N	349	349	
Level of education	Spearman rho (ρ)	-0.010	0.018	1.000
	Sig. (2-tailed)	0.851	0.732	-
	N	349	349	349

**. Correlation is significant at the 0.01 level (2-tailed).

Source: *SPSS Output*

The correlation analysis indicated a weak yet statistically significant relationship between gender and confidence in the use of smart learning tools ($\rho = 0.172$, $p = .001$), suggesting slight variations in confidence levels across genders. In contrast, there was no significant association between confidence and level of education ($\rho = -0.010$, $p = .851$), implying that educational attainment does not affect users' confidence in utilizing smart learning tools.

The results reveal a statistically significant relationship between gender and the use of smart learning tools, suggesting that males may exhibit greater confidence and higher skill levels in utilizing these tools compared to females. This finding contrasts with that of Kanyika et al. (2024a), who also identified a significant relationship between gender and the use of digital tools but reported that females demonstrated higher confidence and proficiency than males. Furthermore, the findings indicate no statistically significant relationship between level of education and the use of smart learning tools. This implies that confidence in using such tools is not influenced by students' educational attainment, and those individuals across different levels of education have comparable levels of confidence in engaging with smart learning technologies. However, these results differ from those of Kanyika et al. (2024b), who found significant relationships between level of education, and competence in using digital tools. Their study suggested that individuals with higher levels of education demonstrate greater competence compared to those with lower levels of education.

4.3.2 Presence of Continuous Professional Development

Students were asked to indicate if their institutions provide continuous professional development related to digital learning. Findings of the study are summarized in Table 5.

Table 5: Presence of Continuous Professional Development related to Digital Learning

		Frequency	Percent	Cumulative Percent
Valid	Very frequently	69	19.8	19.8
	Frequently	177	50.7	70.5
	Occasionally	97	27.8	98.3
	Never	6	1.7	100.0
	Total	***349***	***100.0***	

Source: *Field Data (2026)*

The findings as indicated in Table 5 show that the majority of respondents in general perceive continuous professional development (CPD) activities as being available frequently. For instance, 177 respondents (50.7%) indicated that CPD opportunities are frequently available, while 69 respondents (19.8%) reported that they are available very frequently. This reflects a strong presence of professional development initiatives in digital teaching and learning. Moreover, 97 respondents (27.8%) stated that CPD is occasionally available. This implies that although opportunities exist, they may not be consistent for all participants. On the other hand, a very small proportion (6; 1.7%) of respondents, reported that CPD is never available. This suggests that lack of access to CPD is minimal but still present for a few individuals, indicating that there is still a need to improve consistency and ensure that all students benefit regularly.

The findings indicate that continuous professional development (CPD) on the effective use of smart learning tools is generally provided on a frequent basis. However, some students perceive it as only occasionally available, while others report that it is not available at all. This variation

suggests the need for targeted measures to ensure that CPD initiatives are consistently accessible and clearly communicated to all students. Ensuring that every student recognizes and benefits from these opportunities is essential, as CPD plays a significant role in enhancing their skills for the effective use of smart learning tools. This finding is consistent with the 4T model adopted in this study, which emphasizes the necessity of continuous training in response to the dynamic nature of technological advancement. As technologies evolve rapidly, users must acquire and regularly update the knowledge and competencies required for their effective utilization.

4.4 Integration of Information Resources and Digital Content at EASTC and IFM

The study sought to examine how information resources and digital content are integrated with new technologies to support smart learning.

4.4.1 Integration of Library Services into Smart Learning Platforms

Students were asked to indicate to what extent do library services in their institutions are integrated into smart learning platforms. Findings of the study are as illustrated in Figure 4.

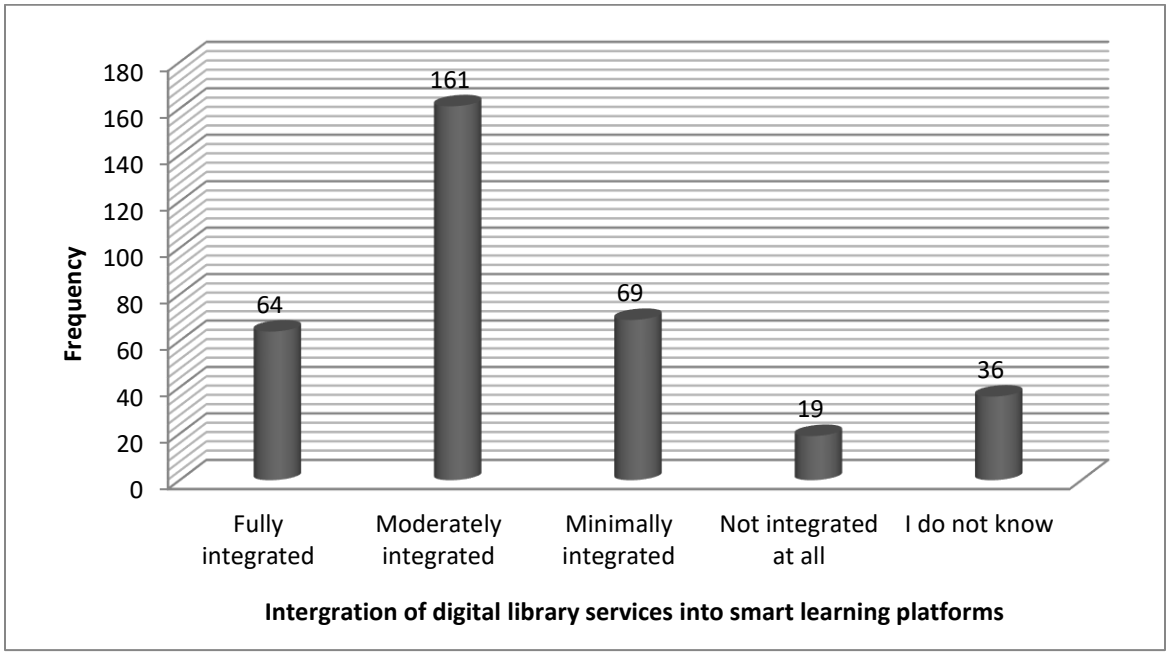

Figure 4: Integration of Digital Library Services into Smart Learning Platforms
Source: *Field Data (2026)*

Based on the findings presented in Figure 4, nearly half of the respondents (161; 46.1%) perceive library services in their institutions as moderately integrated. This suggests that while some level of integration exists, it remains partial and not yet fully developed. In contrast, a notable proportion of respondents (19; 5.4%) indicated that library services are not integrated at all; implying that complete absence of integration is relatively uncommon. Moreover, 36 respondents (10.3%) reported that they don't know whether library services are integrated into smart learning platforms.

This indicates a notable gap in awareness or access to information, highlighting the need for improved communication and sensitization regarding the integration status.

In a smart learning environment, library resources need to be fully integrated with digital technologies to facilitate seamless access to digital content, enabling students to access resources anytime and from anywhere (Naujoks et al., 2021). However, the findings suggest that this integration is not yet complete, which may result in challenges for students when accessing digital resources. Given that higher learning institutions are committed to transitioning toward smart learning, these findings should serve as a wake-up call for management to prioritize the full integration of library resources with digital technologies. This is essential because the library remains the heart of any academic institution; therefore, in a smart learning environment, its resources must be fully digitized and integrated to ensure users can conveniently access digital library services anytime and anywhere (Mursid et al., 2022).

4.4.2 Accessibility of Digital Library Resources

Students were asked to indicate the extent to which they access digital library resources within their institutions. The findings of the study are summarized in Table 6.

Table 6: Accessibility to E-books, E-journals, and Open Educational Resources (OERs)

		Frequency	Percent	Cumulative Percent
Valid	Very adequate access	65	18.6	18.6
	Adequate access	156	44.7	63.3
	Somewhat adequate access	67	19.2	82.5
	Inadequate access	40	11.5	94.0
	No access at all	21	6.0	100.0
	Total	***349***	***100.0***	

Source: *Field Data (2026)*

The study findings indicate that, overall, the majority of respondents perceive access to digital library resources as adequate. Specifically, 156 respondents (44.7%) reported that access is adequate, while 65 respondents (18.6%) considered it to be very adequate. This suggests that a substantial proportion of users are able to access digital library resources within their institutions at an acceptable level. However, a notable proportion of respondents expressed challenges: 40 respondents (11.5%) reported inadequate access, and 21 respondents (6%) indicated that they cannot access digital library resources at all. This highlights the existence of a digital access gap, underscoring the need for institutions to address these disparities by enhancing infrastructure, expanding resource subscriptions, and strengthening digital literacy support.

Possessing digital library resources is one aspect, but ensuring their accessibility to users is another. Academic institutions invest in digital resources with the expectation that users will be able to access them easily; therefore, consistent and reliable accessibility is essential (Huisman & Huang, 2022). The findings indicate that digital library resources such as e-books, e-journals, and

open educational resources are generally accessible in most cases. However, a proportion of respondents reported that these resources are sometimes not easily accessible or, in some instances, not accessible at all. This suggests the presence of underlying factors that hinder access, which management needs to identify and address to ensure that all digital resources provided or subscribed to by the institutions are consistently accessible to users.

In addition, Spearman's rank-order correlation was conducted to see if there is any significance relationship between accessibility to digital library resources and the frequency of use. Findings are summarized as indicated in Table 7.

Table 7: Relationship between Accessibility to Digital Library Resources and the Frequency of Use

		Accessibility to e-books, e-journals & OERs	Frequency in using digital academic resources
Spearman's rho	Accessibility to e-books, e-journals & OERs	Correlation Coefficient	1.000
		Sig. (2-tailed)	-
		N	349
	Frequency in using digital academic resources	Correlation Coefficient	.450**
		Sig. (2-tailed)	.000
		N	349

**. Correlation is significant at the 0.01 level (2-tailed).

Source: *SPSS Output*

As indicated in Table 7, findings show that there is a statistically significant, but moderate positive relationship between accessibility to e-books, e-journals, and OERs and frequency of using digital academic resources ($\rho = .450$, $p < .001$, $N = 349$). This suggests that, there is direct relationship between accessibility to digital academic resources and frequency of their use. In general, the results suggest as that improving access to e-books, e-journals, and OERs is likely to attract students' or users' engagement with digital academic resources. However, since the correlation is moderate, other factors (such as digital literacy, infrastructure, or user motivation) may also influence usage and should be considered in further analysis.

The findings indicate that, in order to encourage students to frequently utilize digital content in libraries, it is essential to ensure that these resources are easily accessible. The frequency of use largely depends on the level of accessibility of the digital tools. As noted by Lagstedt et al. (2020), most digital tools employed in libraries are designed to enhance access to information. Therefore, for management to realize the benefits of their investments in transitioning to smart learning and for students to fully benefit from this shift, it is recommended that all digital tools be made readily accessible to users.

5.0 Limitation of the Study

This study is limited to students and excludes lecturers. Although the initial design intended to include both groups given that the transition to smart learning affects them equally, data collection yielded a very low response rate from lecturers over a three-month period. As a result, the lecturer responses were insufficient for meaningful analysis. Due to time constraints associated with preparing the first draft of the manuscript, particularly because the study was funded by EASTC, lecturers were excluded from the final analysis. Accordingly, future studies should incorporate both students and lecturers to provide a deeper understanding of the readiness for transitioning to smart learning in higher learning institutions, including policy-related implications. In addition, this study was confined to only two higher learning institutions, which limits the generalizability of the findings. Future research should broaden the scope by including a diverse range of higher learning institutions, both large and medium-sized, to achieve a more comprehensive understanding of readiness for the transition to smart learning.

6.0 Conclusion and Recommendations

The transition to smart learning is increasingly being adopted by higher learning institutions; however, the pace and quality of this transition vary between developed and developing countries due to factors such as financial capacity. In developing countries, for instance, although there is a clear commitment to shifting from traditional learning approaches to smart learning, significant efforts are still required to ensure a seamless smart learning environment. The findings of this study indicate that, in general, EASTC and IFM are prepared to transition to a smart learning environment. Nevertheless, despite the availability of internet connectivity, improvements are needed in terms of performance, as this was identified as one of the key challenges. The study also revealed the presence of smart classrooms; however, in some cases, these facilities are not fully functional. Additionally, the findings show that students generally possess strong digital skills, which support the effective use of smart learning tools. Furthermore, the integration of digital library services into smart learning platforms remains incomplete, posing a barrier to accessing digital library resources.

Based on these findings, the study recommends that, to ensure a smooth smart learning environment, institutional management should ensure that all supporting technological infrastructures particularly internet connectivity, is reliable, stable, and high-performing at all times. Moreover, there should be an adequate number of smart classrooms, and more importantly, all associated digital technologies must be fully functional. Finally, higher learning institutions should prioritize the full integration of digital library services into smart learning platforms to enable students to access digital library resources conveniently and at their own pace.

Data availability

Data will be available upon request

Conflict of Interest

The authors declare that there are no known conflicts of interest to report.

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