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Towards Personalised Learning in Higher Learning Institutions in Tanzania

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ABSTRACT

This study examines the challenges and students' perceptions of adopting and implementing e-learning in Tanzanian universities to facilitate the shift towards personalised learning. Although technology and online courses provide chances to customise training for unique student requirements, challenges impede the successful incorporation of e-learning in Tanzanian higher education, particularly regarding user training and technical support. The absence of crucial amenities for online education, such as computer laboratories and dependable internet connectivity, exacerbates the challenges in executing implementation endeavours. We employed a mixed-methods approach to investigate universities' preparedness for implementing e-learning and evaluate the impact of e-learning platforms and Artificial Intelligence (AI) in facilitating personalised learning experiences. Our findings emphasise the significance of tackling identified obstacles to enhance education quality and provide a basis for customised learning. Subsequent studies should focus on filling the existing voids to improve the incorporation of artificial intelligence in e-learning platforms, explicitly addressing the obstacles faced by universities in underdeveloped nations. The study suggests that institutions should allocate resources towards developing e-learning infrastructure, offer extensive training for instructors, and create customised e-learning methods.

Key Words: Artificial Intelligence, e-learning, ICT, Customised learning, learning, Personalised learning.

1. INTRODUCTION

In recent years, universities have invested significantly in Information and Communication Technology (ICT) and advanced digital media to create online learning platforms to enhance the learning experience [1, 2]. With the evolving ideas on learning processes, digital technologies have become essential tools for facilitating learning activities [3]. Van den Akker et al. (2003) categorised information and communication technologies into three prominent roles: as a subject of study, as a field component in a specific occupation, and in the classroom as a tool for teaching [4].

However, e-learning has become a prevalent method in higher education globally. Tanzanian universities are presently researching the implementation of e-learning to facilitate personalised education and enhance the quality of competent instruction. E-learning entails the practice of self-education using digital media, particularly in online courses that utilise technology to create and distribute course materials [5]. Static content was the predominant feature of earlier, less sophisticated types of online Education [6]. Despite students' universal access to learning materials, they lacked the adaptability to meet individual learners' varying needs and preferences. Several online learning platforms have surfaced in response to the need for more adaptable pedagogical methods. These have found widespread use in educational institutions across the globe, including Tanzania [7]. Due to technological advances and the availability of virtual learning and hybrid instruction, higher education is becoming more student-centred. The motivation behind this

transition originates from the necessity to accommodate learners' diverse learning styles and interests [8]. ICT employs data-driven artificial intelligence (AI) to adapt students' learning experiences within educational institutions dynamically [9, 10]. Personalised instruction supersedes the conventional "one-size-fits-all" approach strategy, adapting to individuals' distinct learning styles, paces, and abilities by utilising data and algorithms inherent in customised education, which aim to improve accessibility and promote academic success.

Furthermore, ICT underpins an information-based economy where rapid access to vital information drives an economically sustainable future [11]. ICTs are known for bridging the digital gap and encouraging lifelong learning, attracting higher learning institutions in Tanzania to launch their study programs with e-learning to use ICTs and provide a personalised learning environment [12-14]. However, the initiative had many obstacles. Thus, this research seeks to analyse the challenges and provide solutions. The study collects data using various methods and analyses it statistically.

2. LITERATURE SURVEY

2.1 E-Learning-Evolution

E-learning utilises technology and digital resources to enhance learning [15]. This approach uses Information and Communication Technology (ICT) tools to improve education and differentiates itself from conventional classroom instruction in processing information. While everyone understands that learning involves acquiring new information and understanding, the technique used in e-learning sets it apart. E-learning can be defined as a learning process facilitated through the digital delivery of content, network-based services, and tutor support [16]. This process signifies transitioning from traditional education to a collaborative learning model underpinned by ICT channels [17]. Characterised by personalisation, self-organisation, and flexibility, e-learning leverages internet technology to enhance knowledge acquisition and performance. It empowers learners to control the content, pace, and learning processes, tailoring their experiences to meet their objectives [18, 19].

As e-learning systems gain more importance, they must adapt and provide intelligent services [20, 21]. This evolution entails systematically utilising AI technology to collect, preprocess, analyse, store, and visualise vast amounts of data from diverse learning sources [22]. These technologies play a crucial role in enhancing the effectiveness of e-learning by minimising irrelevant distractions and extracting useful information, thereby enabling a more personalised learning experience [23]. Moreover, they customise educational materials according to individual learners' levels of involvement with the content and their interactive actions [24]. As e-learning systems continue to advance, it is crucial to integrate intelligent technologies to improve learning outcomes and tailor instructional content to meet the diverse needs of learners [25, 26].

2.2 Personalised Learning Environment in Higher Learning Institutions

The increasing use of e-learning in personalised learning environments in higher education indicates a significant shift from traditional classroom models [27, 28]. In contrast to conventional settings, virtual environments prioritise individual learners, providing personalised techniques designed to meet their specific educational needs [29, 30]. However, learners encounter a notable obstacle when they navigate these systems independently, which may substantially impact their attitudes and actions toward learning [31-33]. Web-based learning offers an appealing proposition by overcoming temporal and spatial constraints, allowing students to interact with instructional content regardless of physical limits or time constraints [34]. This intrinsic flexibility highlights the growing popularity of web-based systems, which put learners in complete control of their academic paths [32, 35]. While this transformative growth continues, a significant worry emerges about identifying critical skills for learners' development in these dynamic situations [36].

Recent advances in educational technology highlight the effectiveness of personalised learning systems, which use AI to tailor educational experiences to specific students [37-39]. These advanced technologies expertly assess participants' comprehension levels and preferred learning modalities before delivering curated content and exams designed to optimise the learning journey [40]. However, successfully integrating e-learning systems into the semantic web context and achieving adaptive personalisation are significant challenges [37, 41, 42]. An ontology-driven

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approach incorporating the Felder-Silverman learning style model shows promise in resolving these difficulties by allowing for the customisation of learning content within the semantic web framework [43]. This unique method ushers in a new era of Tanzanian higher education, generating more immersive and compelling learning environments that meet the different requirements of learners [44, 45].

2.3 Challenges in E-Learning towards personalised learning

Implementing e-learning activities in African Education, particularly in Tanzania, is hampered by substantial challenges to e-learning infrastructure, particularly internet connectivity [46, 47]. A recent survey by EdTech specialists revealed persistent issues encountered during the COVID-19 outbreak, such as restricted technology availability and high internet access costs [47, 48]. Despite modest advancements, internet connectivity remains relatively low, limiting the usage of e-learning systems [49]. Fewer than 4% of students and faculty use these technologies, according to a study conducted at the University of Dar es Salaam. Network problems and unstable power grids represent substantial challenges to the smooth adoption of e-learning in higher educational institutions [48].

Although e-learning provides significant benefits to learners in terms of customisation, availability, and the capacity to evaluate the accuracy of their responses, e-learning systems face several challenges [37, 50]. Teacher-created educational materials and evaluations fail to accommodate individuals with diverse knowledge and learning capacities. The objectives of such e-learning systems are thus not met [51]. Continuously giving students practice questions causes them to lose interest, make no academic progress, and develop a lack of motivation to continue. As a result, to ensure the flexibility and success of the e-learning system, the complexity level of exercises should be set by the learner's expected rate of acquiring knowledge of the course material [52]. This study focused on e-learning problems from students' perspectives and stressed the importance of instructor engagement in e-learning implementations towards personalised learning.

3. RESEARCH OBJECTIVE

Recent research has concentrated on e-learning applications and problems, with little emphasis on student views and the significance of teacher interaction in personalised learning [53]. This research investigates the shift to personalised learning within higher education institutions in Tanzania. The results connect current studies on personalised learning and guide future developments in educational technologies.

3.1 Research Questions

Therefore, the following three research questions guided the study:

RQ1: What are the perceptions and experiences of e-learning towards personalised learning adoption from the students' perspective in higher learning institutions in Tanzania?

RQ2: How can AI improve the quality of e-learning and encourage adopting personalised learning in HLI?

RQ3: What are the barriers to students' acceptance and implementation of e-learning in higher learning institutions in Tanzania?

4. RESEARCH METHODOLOGY

This study adopted qualitative and quantitative methods to collect and analyse data from six chosen universities in Tanzania. The main participants were students selected from six renowned universities in Tanzania – the University of Dar es Salaam (UDSM), the Open University of Tanzania (OUT), Sokoine University of Agriculture (SUA), Mzumbe University (MU), Dar es Salaam Tumaini University (DarTU) (formerly known as Tumaini University Dar es Salaam College (TUDARCo)), and the St. Augustine University of Tanzania (SAUT). We carefully selected our sample size of 1032 participants to guarantee the correctness of quantitative data. This sample comprises 120 instructors, 900 students, and 12 e-learning administrators who actively participated in interviews.

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We designed the survey questions to ensure that responders thoroughly understood the topic. To gain qualitative insights, we interviewed academics, students, and e-learning administrators in-depth, asking open-ended questions about their experiences and perspectives. Our quantitative data analysis used descriptive and inferential statistics, and our qualitative data analysis used interview thematic analysis. This comprehensive approach provided nuanced insights into personnel engagement with e-learning systems, university e-learning prevalence, infrastructure, teaching staff and student familiarity, and implementation challenges. Python and MATLAB performed the statistical analysis, while Microsoft Excel facilitated additional data manipulation and visualisation.

5. RESULT AND DISCUSSION

Respondents rated each category based on its importance in teaching and learning. The tables of results and figures present responders' appraisals based on questionnaires. According to students and instructors, all information points are essential when developing and implementing an e-learning platform.

5.1 Perceptions and experiences of e-learning towards personalised learning adoption

The study gathered feedback from respondents on using e-learning for personalised learning by administering a questionnaire. We received 1,032 responses, with 87% of them being students, 12% being instructors, and 1.2% being e-learning administrators. Of the participants, 44% identified as female, whereas 56% identified as male. The age group with the highest representation was between 18 and 35 years. Regarding the composition of the faculty, 53% were assistant lecturers, 37% were lecturers, and 10% held the positions of senior lecturers and professors. Figure 1 demonstrates the educational proficiency of the students.

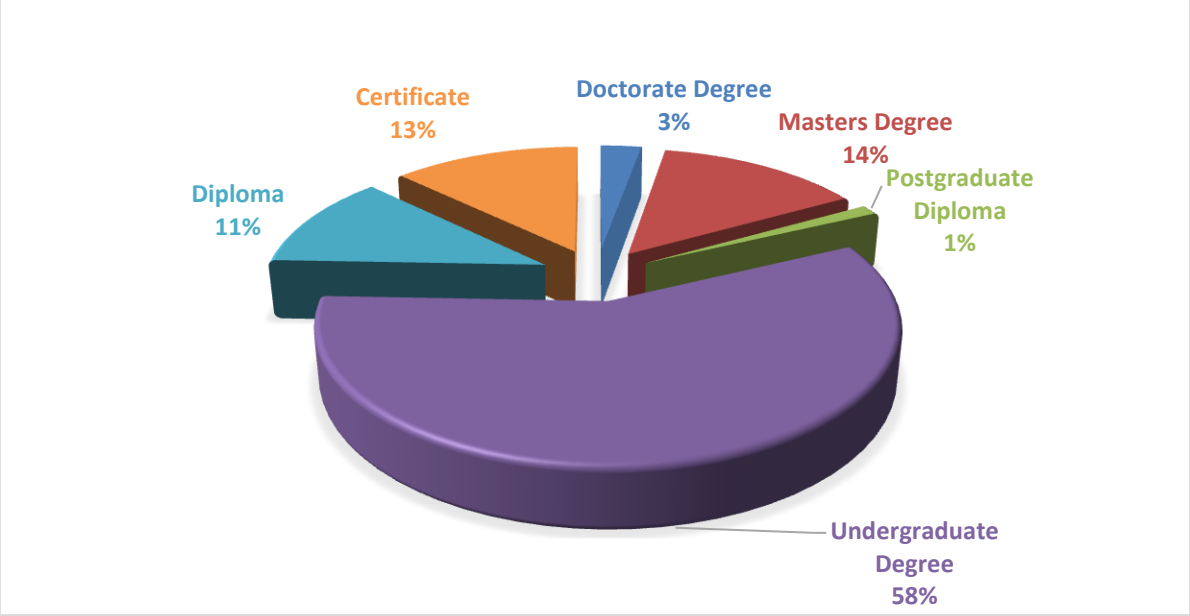

Figure 1. Distribution of student responses in various academic award categories (Field Research 2024)

The findings show how respondents' educational backgrounds affect their perspectives and experiences with implementing personalised learning. Out of all the respondents, 58% were undergraduate degree students. Then there are 13% with a certificate, 11% with a diploma, 14% with a master's, 1.20% with a postgraduate diploma, and 2.80% with a doctorate.

The student learning preferences revealed that more than 47% prefer online learning, 39% choose face-to-face instruction, and 14% favour mixed learning. Figure 2 displays the distribution of options among the participants in our study, illustrating these preferences.

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The research results reveal that about 63% of students are highly motivated to use e-learning resources, as they not only attend face-to-face classes and engage in personal study but also sign in to their virtual courses daily, spending 1 to 2 hours on them. Additionally, approximately 22% of students allocate around 4 hours daily to the online e-learning platform. Figure 2 exhibits the distribution of students' daily study hours within the e-learning system.

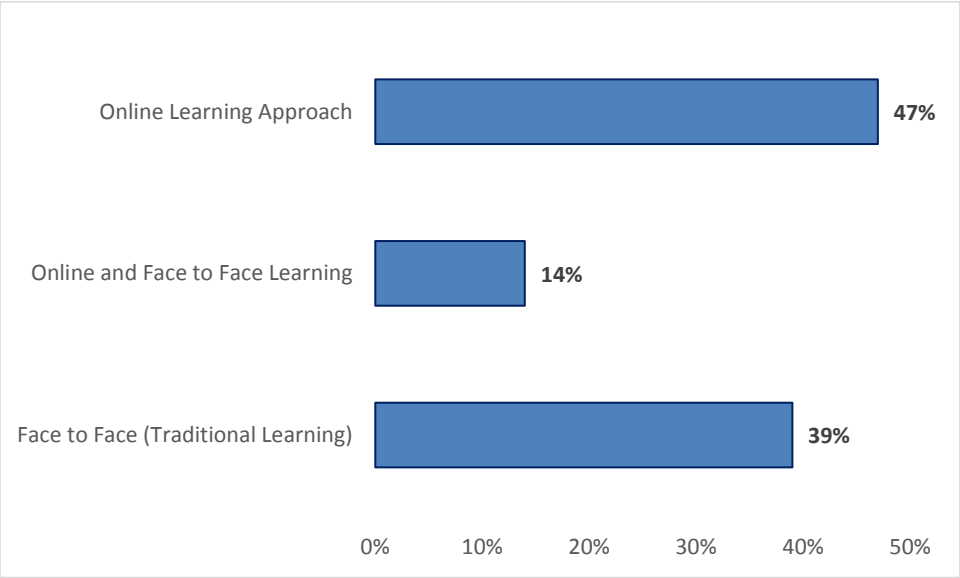

Figure 2. Student preferred pedagogical approach (Field Research 2024)

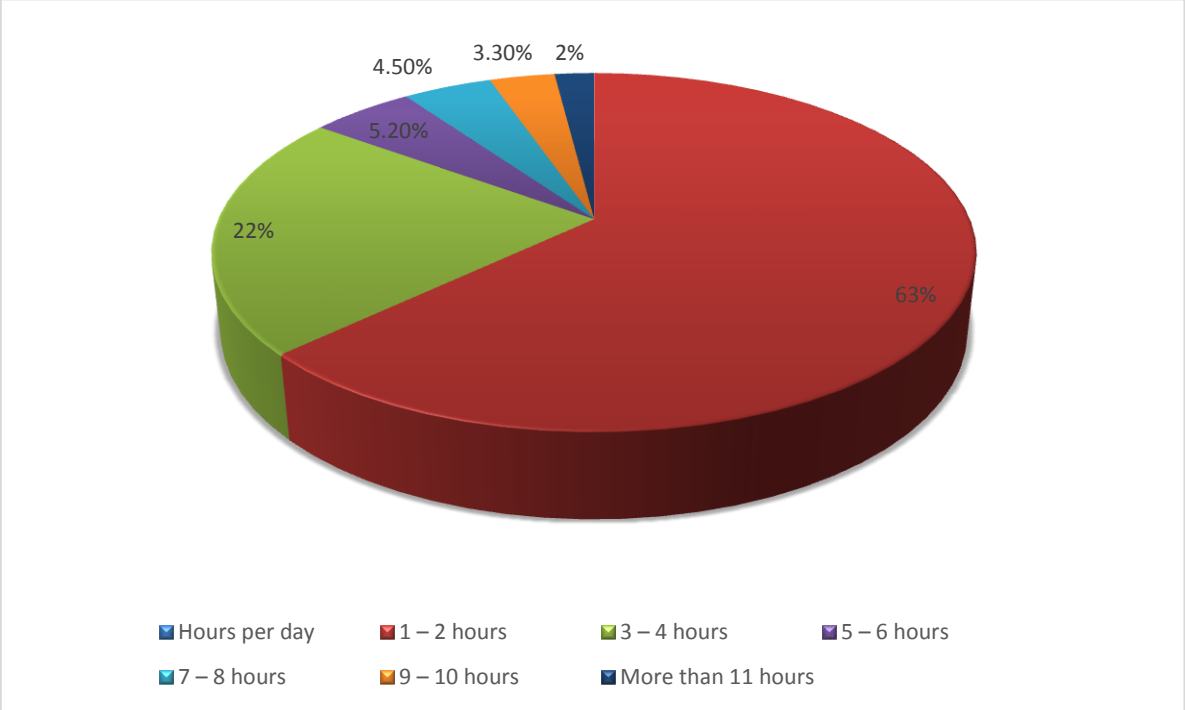

Figure 3. Students' time spent on the e-learning platform (MOODLE) (Field Research 2024)

5.2 Integrating AI into e-learning to support personalised learning in Higher Education

The research question (RQ2) seeks to explore the potential of AI in improving the quality of e-learning and promoting the implementation of personalised learning in higher learning institutions (HLIs). The findings show a strong consensus among respondents about AI's capabilities to improve e-learning and implement customised learning in HLIs. However, most students (73%) strongly agreed that instructors should receive more e-learning methodologies and technological skills to support online education and personalised learning. Furthermore, a sizable % of students

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(81%) stated that using AI technology may improve students' e-learning quality and that AI could help HLIs implement personalised learning more efficiently (75%), as shown in Figure 4 of the learners' survey.

The study also emphasises the necessity of training and development in AI and e-learning approaches among educators, as shown in Table 1 of the instructors' survey. The students' study guides give their perspectives on AI's involvement in improving the quality of online education and fostering individualised learning at the university level. According to the findings, instructors believe AI will boost online education. When asked if they thought e-learning systems should use AI for personalised learning, 83% of instructors agreed. Furthermore, 88% of instructors supported employing AI and big data to improve e-learning for different learning styles, as seen in Table 1 of the instructors' survey.

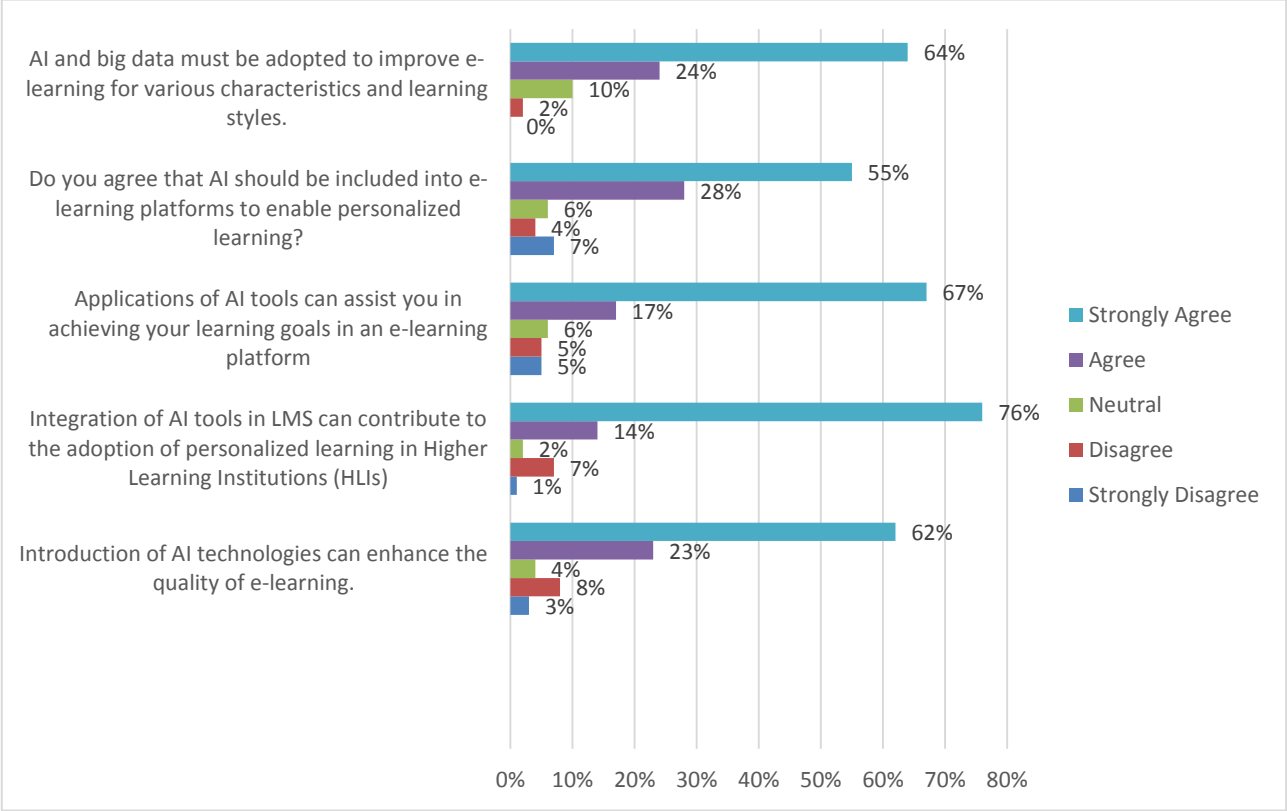

Figure 4. Students' opinions on how AI in e-learning promotes personalised learning (Field Research 2024)

Table 1. Instructors' opinions on how AI in e-learning promotes personalised learning (Field Research 2024)

To what extent do you agree regarding the role of AI in facilitating the adoption of personalised learning	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I agree instructors need more e-learning strategies and technology training to improve online education and personalised learning.	4%	2%	6%	15%	73%
Integrating AI technologies can enhance the quality of e-learning for students.	2%	1%	1%	15%	81%

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AI can help Higher Learning Institutions (HLIs) implement personalised learning more efficiently.	3%	2%	9%	11%	75%
AI can increase personalised learning for e-learning students.	11%	6%	3%	9%	71%
Using AI techniques and accessing students' data helps provide students with tailored learning experiences.	3%	4%	0%	19%	74%
Do you support AI in e-learning systems to improve assessments and predict performance in class?	1%	5%	6%	20%	68%

The findings of the research question (RQ3) "What are the barriers to students adopting e-learning in higher learning institutions in Tanzania?" Based on a sample size of 900 students and 300 instructors, the results show notable results on the multifaceted nature of impediments to e-learning implementation to adopting personalised learning in Tanzanian higher education institutions (Figure 5).

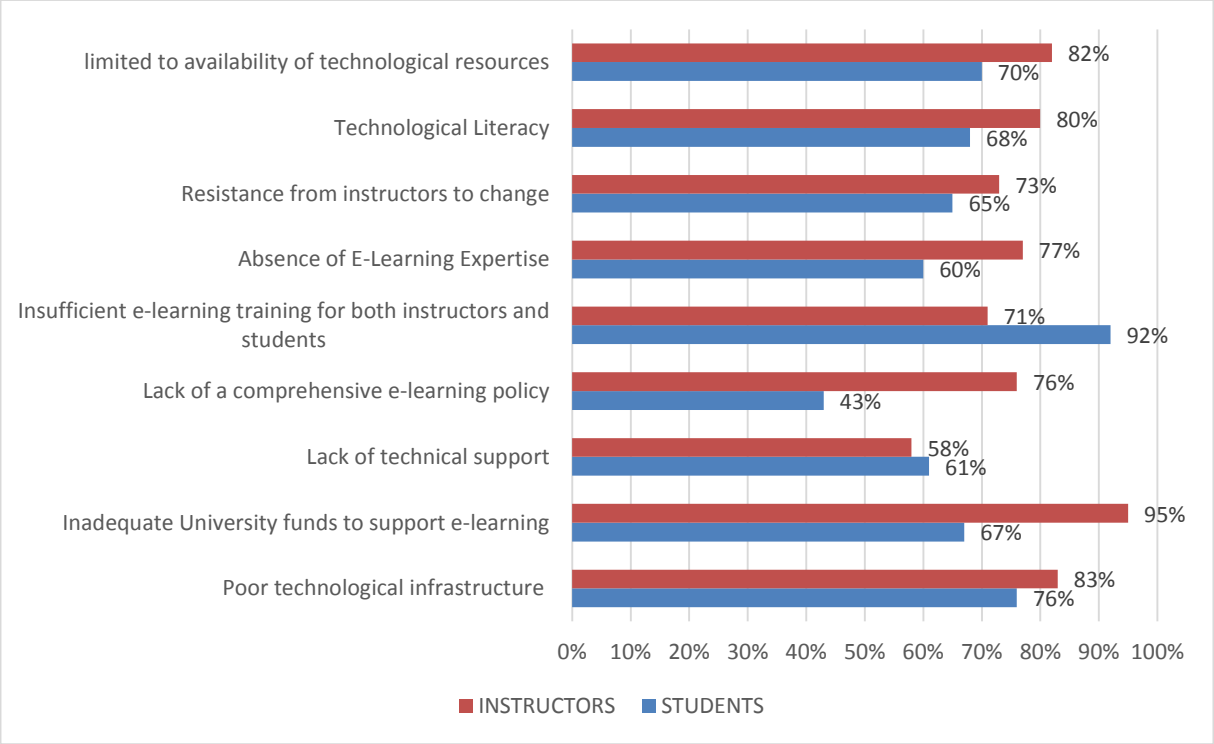

Figure 5. E-learning barriers faced Higher Learning in Institutions in Tanzania (Field Research 2023)

This research examined the perspectives and experiences of online students regarding the implementation of e-learning and their resultant actions in adopting customised learning. The study found that the majority of the student respondents preferred online learning. These reflections represent the shift in higher education towards student-centred teaching methods and practices facilitated by new technologies and the increased availability of online and blended courses. The growing emphasis on personalisation and flexibility in higher education necessitates an equal focus on assessment techniques to provide a unified learning experience [54]. However, the e-learning environment affects

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perceived ease of use and usefulness. The results indicate that perceived ease of use mediates the relationship between personalised learning environments, learner attitudes, and satisfaction.

Furthermore, satisfaction mediates between perceived ease of use and the intention to use e-learning modules. E-learning has had a significant positive impact on perceived efficacy. The findings also reveal that students' academic levels and types of learners influence their attitudes, satisfaction, and intentions to engage with the e-learning module in distinct ways [55].

Nevertheless, medical learners and instructors favoured face-to-face, all-encompassing instruction, according to research by Atwa et al. (2022). They believed online education might replace conventional instruction and clinical tasks like patient interviews and case discussions. Despite the COVID-19 pandemic's impact on traditional in-person medical education, they saw blended learning as a practical alternative [56]. In a previous study, Tanis (2020) added that educators should utilise a curriculum matrix to plan online courses and list learning goals, assignments, and assessments. Virtual and in-person classes use the Carnegie hour calculation to determine class and independent study time. Over a 15-week semester, undergraduates and graduate students receive two or three hours of out-of-class work for each hour of instruction [57].

More than half of the students are motivated to use e-learning platforms, spending 1 to 2 hours daily on virtual courses. According to Figure 3, a quarter of the students use the online learning platform for an average of three to four hours daily. The analysed results indicated that students were motivated to use e-learning platforms to enhance their learning performance and ease discussions regardless of time and location. However, during the interview, both lecturers and students responded to the convenience of accessing learning materials at any given time without geographical boundaries. In addition, they can stay abreast of the most recent developments and news. Students became more interested in the approach because they could monitor their academic progress, while instructors could oversee their students' performance. This approach streamlines the learning process, making it more efficient and effective for individualised learning. In a study conducted in 2013, Amandu and colleagues confirmed these findings, stating that Moodle is a powerful online learning platform. It lets teachers modify their teaching methods to engage students and encourage independent course participation, which applies to all student-focused electronic learning management systems. When appropriately implemented with reusable learning resources, these systems improve self-directed learning (SDL), giving learners control over their pace and enthusiasm [58].

Analysis of responses revealed that AI could improve e-learning and foster individualised curriculum development at HLIs. Approximately 85% of students who answered the survey think AI has the potential to make online education better. However, AI-powered platforms and solutions must follow user-centred design principles, and priorities should satisfy student needs and preferences [59]. In addition, 90% think universities can benefit from personalised learning when incorporating AI techniques into LMS. Most students (around 84%) believe AI apps can help students succeed academically. In addition, 83% think e-learning platforms should use AI to allow personalised learning. About 88% of students believe that adopting AI and big data is crucial for developing e-learning that adapts to various learning styles based on student profiles. These results show a lot of agreement about how AI can improve online education and help with individualised lessons in universities. The study conducted by Chen et al. (2020) proves the widespread adoption of AI in education, notably within HLIs. Instead of initially adopting computer technologies, AI expanded to web-based intelligent education systems and chatbots to enhance learning quality. These AI tools facilitate independent and collaborative teaching, enhancing educators' efficiency in administrative tasks such as grading and reviewing student work. As part of AI machine learning algorithms and adaptability, e-learning platforms offer customised curriculum and content, improving student engagement and retention [38, 60].

Comparably, the survey results from instructors highlight the importance of AI in transforming e-learning environments by enabling personalised learning experiences, boosting educational standards, and improving evaluation methods, as seen in (Table 1). These findings are helpful for lecturers and other interested parties who seek to use AI technologies to enhance the learning experience and student achievement in e-learning environments. Further research indicates that using AI in education can overcome physical barriers associated with geographical boundaries, as instructional materials can be available worldwide via the internet [61, 62]. However, most instructors

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use AI applications fundamentally for formative assessment, such as automated student grading [63]. Integrated AI helps the instructor reduce the marking workload, provides grading equality to many enrolled students, and creates meaningful communication among instructors and learners [64].

Studies show an increasing inclination toward implementing e-learning systems in universities in Tanzania [65]. However, challenges still hold back the adoption of e-learning at universities in Tanzania. This research finding identified several obstacles when 95% of instructors identified insufficient finance and organisational support as barriers to implementing personalised learning in HLIs, as supported by the study conducted in Zimbabwe [66]. On the other hand, the study emphasised difficulties in purchasing and installing ICT infrastructure, covering running costs for internet services, and students' financial constraints in acquiring e-learning resources. Insufficient e-learning training, infrastructure, and technology resources, such as computer laboratories and internet access, were also deficient. Mwandosya (2023) agreed that e-learning adoption in higher education has encountered many challenges, and the study materials design process focused on the unique institutional e-learning policy, which encompasses IT technology success stories and issues associated with online education. Most instructors (76%) and students (46%) believe universities do not have comprehensive e-learning approaches. 73% of instructors resisted change primarily due to their mistrust of online learning, worries about student workload, and age or disciplinary factors. These findings imply that Tanzanian universities may benefit from e-learning methods in customising their courses to meet the needs of each student if they establish e-learning policies in universities to tackle identified challenges to enable the smooth adoption of e-learning [58, 67].

6. CONCLUSION AND RECOMMENDATION

This study explored the changing environment of personalised learning at higher learning institutions (HLIs) in Tanzania, specifically focusing on the viewpoints and encounters of online students to the adoption of e-learning. The results emphasised a notable transition towards teaching techniques that prioritise the needs and involvement of students, which is made possible by technological developments and the growing accessibility of online and blended courses. Although there is an increasing focus on customisation and adaptability in higher education, there are still difficulties in successfully applying personalised learning methods.

The study emphasised the importance of e-learning platforms in facilitating personalised learning experiences. It found that students are highly interested in using these platforms to improve their academic performance and engage in discussions, regardless of time and location. In addition, educators have acknowledged AI as a feasible method for improving e-learning and promoting the creation of customised courses. Most students exhibited an optimistic perspective regarding the potential of AI to improve online education and enable personalised learning. They focused on employing user-centric design concepts to ensure effectiveness and contentment. However, more research exploring creative ways to use AI in e-learning platforms to enhance the personalisation of learning experiences is required, focusing on specific challenges in universities in developing countries. Any efforts to implement personalised learning must carefully consider the unique circumstances in these areas. Stakeholders at higher education institutions can benefit significantly from a comprehensive evaluation of the efficacy of various e-learning methods and their effects on student performance.

The research findings propose several recommendations to improve the adoption and effectiveness of personalised learning in Tanzanian HLIs. Investing in the infrastructure for e-learning is crucial for overcoming obstacles in implementing personalised learning. It is essential to address financial limitations and secure organisational support. Universities should prioritise investing money to procure and build ICT infrastructure, cover internet service expenses, and grant students access to e-learning resources. Also, it is crucial to create comprehensive training programs to provide instructors with the essential skills and knowledge required to properly use e-learning platforms and integrate AI technology into their teaching methods. It will be crucial to assist in overcoming resistance to change and ensuring that faculty members are ready to embrace new instructional approaches. Tanzanian universities should develop comprehensive e-learning strategies tailored to tackle online education's unique challenges and benefits. These will create comprehensive, adaptable, and captivating educational experiences that empower students and promote academic achievement.

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