

Evaluation of E-Learning Platforms under the EASTRIP Project: Enhancing Competency-Based Education and Training through Holographic Technology in Dar Es Salaam, Tanzania

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Abstract: This study delved into the use of hologram technology to bridge the practical learning gaps in the Competency-Based Education and Training framework when using E-learning platforms. The study utilized a convergent mixed-method, combining quantitative and qualitative approaches. The study focused on 26 public tertiary learning institutions located in Dar es Salaam. It selected 14 widely used e-learning platforms for a comprehensive analysis, ensuring diverse representation. The study's statistical treatment included descriptive statistics and content analysis. The study concluded that the platforms are crucial in delivering content and in teaching, uploading lecture notes and administering tests. However, the use of technology in final examinations and practical assignments indicates notable gaps that need addressing, requiring advanced technologies such as hologram. Addressing these gaps will require technological advancements and continuous professional development for academic staff to optimize the use of e-learning platforms and ensure they meet the comprehensive needs of modern education. This holistic approach will strengthen the alignment of e-learning practices with the CBET framework, fostering a more effective and inclusive learning environment.

Keywords: E-learning; e-learning effectiveness; competency-based education and training (CBET); hologram; online assessment; challenges.

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Introduction

The use of Information and Communication Technology (ICT) has revolutionized various industries including education and transport. In education, ICT has brought transformation by providing new methods of delivering and accessing information, increasing students' engagement, interaction and expanding educational opportunities to a wider audience (Limbu & Yun, 2021). It has also enabled the development of new teaching strategies and assessment techniques as well as streamlined administrative tasks for educators.

With the advent of ICT, educational resources can be easily accessed online, enabling learners to access course materials and engage in interactive activities from anywhere, at any time. This has made education more accessible, flexible, and convenient, allowing learners to study at their own pace and according to their learning styles. E-learning has also enabled institutions to reach a wider audience, allowing them to deliver courses to learners who may not have had access to education otherwise (Hsu, et al., 2021).

In contrast, traditionally, education relied heavily on face-to-face interactions, with students taking notes and undergoing examinations to assess knowledge acquisition. Traditional education, characterized by face-to-face interactions, offers several advantages, including immediate feedback, direct engagement and developing social and practical skills through group activities and discussions for smaller group learners. This in-person approach supports hands-on learning in a controlled environment, facilitating knowledge acquisition and real-time clarification (Sudeep, 2013). However, it also has disadvantages, such as limited flexibility and accessibility, as it requires physical presence, which can restrict participation due to geographical, time or personal constraints. Additionally, traditional education often relies on standardized testing and lecture-based methods, which may not accommodate diverse learning styles and individual needs.

However, the advent of ICT has introduced new teaching and learning methods, empowering students to seek knowledge and skills actively via the Internet (Rahimi & Oh, 2024). This learning facility is called E-learning. According to Fülöp (2023), E-learning delivers educational content and experiences through digital platforms, typically online. It allows learners to access courses, materials and interactive tools remotely, offering

flexibility and convenience. E-learning includes various multimedia elements, enhancing engagement and supporting diverse learning styles. It is widely used in education and training, making learning more accessible and often more cost-effective. Three-dimensional (3D) technology has further enhanced learning by providing realistic visualizations that deepen understanding (Yoo et al., 2022; Sudeep, 2013). This shift has enabled students to apply their acquired knowledge in real-world contexts.

The integration of technology has not only made educational resources more accessible but also improved the delivery and effectiveness of teaching. Tools such as computers, mobile phones and educational applications have facilitated a more interactive and engaging learning experience (Rodríguez, 2022). This, in one way, supports CBET principles by empowering students to take control of their learning journey, exploring a wide array of information beyond traditional classroom boundaries. CBET is known for its ability to empower learners to take charge of their learning through self-study. On top of that, applications like Microsoft Teams, Zoom and Microsoft Office have bolstered distance learning, providing rapid access to information and accommodating the high demand for education with limited academic staff (Kalansooriya et al., 2015; Rodríguez, 2022).

Despite ICT's advantages in enhancing online education delivery in Tanzania's tertiary institutions, the tools are deficient for delivery (Tanzania Commission for Universities, 2024, January), raising questions about the CBET philosophy's effectiveness. This is also supported by the study conducted by Dunagan and Larson (2021), who suggested that there is a need for alignment of competency-Based learning and assessment to adaptive Instructional systems. The gap exists because online teaching can provide resources like notes and online quizzes but cannot offer practical assignments or supervise practical sessions, which require close instructor guidance. The ability of these systems to offer notes and online quizzes but not offering practical assignments makes the CBET approach inefficient. Online platforms effectively deliver theoretical knowledge but fail to develop practical skills requiring hands-on experience. They can provide foundational understanding but often lack the depth needed for real-world application and comprehensive engagement. Moreover, online

learning is limited in cultivating broader attributes like teamwork, communication and problem-solving skills, which are best developed through direct interaction and experiential learning. To support the goals of CBET fully, enhancing e-learning through technology or a blended approach that integrates practical experiences with digital resources is essential to complete all four components of CBET: knowledge, understanding, skills and broader attributes. This study explores new strategies to improve the e-learning education system and leverage emerging technologies to align with CBET principles, emphasizing knowledge, skills, understanding and broader attributes. To achieve the CBET objective, learners must attain four competencies: knowledge, skills, understanding and broader attributes to be awarded the National Technical Award (NTA) to meet the market demand.

Conceptual Framework

The framework presented in Figure 1 delineates the competencies essential for students at the NTA levels, displaying the augmented impact of hologram technology. According to Sudeep (2013),

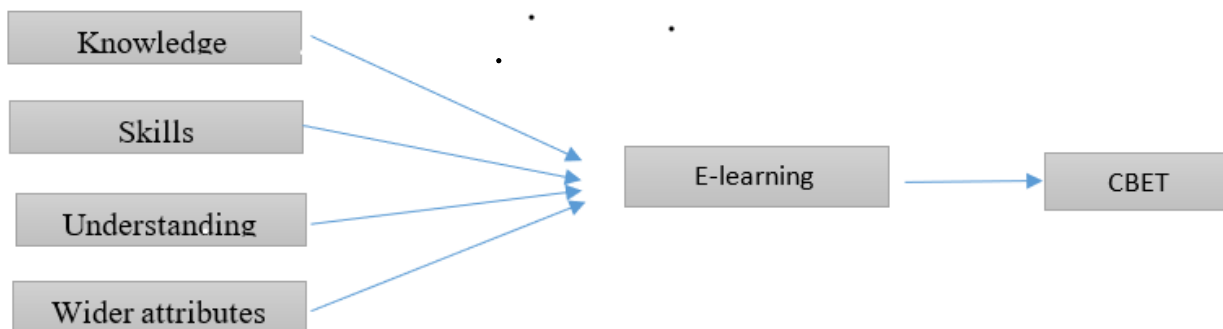


Figure 1: A conceptual framework for a conventional E-learning

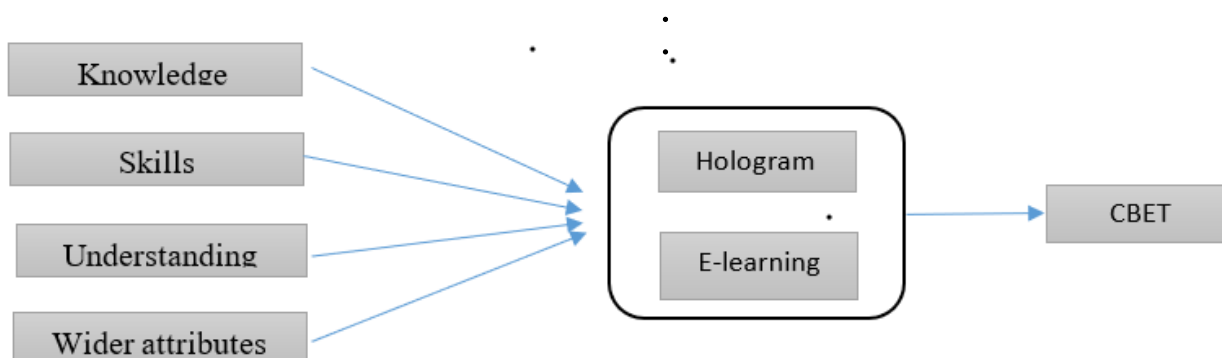


Figure 2: A conceptual framework for E-learning enhanced with hologram

The framework highlights hologram technology as a supportive tool that enhances E-learning and aligns the approach with the CBET philosophy. To attain the NTA award, learners must demonstrate

holograms are a technology that uses three-dimensional (3D) virtual representations of objects or individuals, creating a more immersive and realistic visual experience for users. Figure 2 depicts how conventional E-learning, integrated with holograms enhances the visual presence of an instructor during practical sessions on practical subjects. This advancement enhances the learning experience by providing a more immersive and visually engaging platform for students in practical-oriented disciplines. Examples of such disciplines include engineering, where students can visualize complex machinery and structural designs, medical training, where holograms can simulate anatomical structures for better understanding and practice, technical education, where hands-on skills in areas like automotive repair or electronics can be demonstrated in detail and architecture, where 3D models of buildings can be explored interactively. This technology allows students to engage with realistic simulations that are difficult to replicate through traditional e-learning methods.

competence in Knowledge, Skills, Understanding and broader attributes for a specific level. Failure to meet all the required components will result in

retaking the course(s) until successful completion (National Council for Technical Education, 2024).

Literature Review

Scholars such as Dasgupta and Lin (2021), Fülöp et al. (2023) and Zalat et al. (2021) have thoroughly examined the challenges associated with E-learning, particularly in the context of accommodating a large student body with limited academic staff in tertiary education. They highlighted significant advantages, such as the ability of E-learning to democratize access to education and offer flexible and scalable learning opportunities. E learning facilitates a broader reach, enabling institutions to enroll more students than traditional classroom settings would allow. This scalability is particularly valuable in contexts with resource constraints. Moreover, e-learning platforms can support self-paced learning, allowing students to manage their studies according to their schedules.

However, these studies also underscored critical disadvantages. A significant issue is the difficulty in providing personalized attention and adequate support to many students, exacerbated by the limited academic staff available to manage large online classes (Fülöp et al., 2023; Zalat et al., 2021). This limitation can lead to a lack of engagement and insufficient guidance, which are crucial for students' success. Additionally, the lack of robust infrastructure and technological resources can impede the effective delivery of online education. Dasgupta and Lin (2021) noted that this infrastructural deficiency can lead to inconsistent access to quality education and affect learning outcomes. The scholars stressed the need for innovative strategies and technological advancements to address these challenges, ensuring that e-learning can effectively meet diverse student needs while upholding academic standards.

As technology seamlessly intertwines with pedagogy, the literature surrounding E-learning becomes a rich tapestry of insights and innovations. The author has categorized the existing literature into three groups for this study.

Conventional E-learning

The initial body of literature delves into conventional E-learning. According to a study by Abrami et al. (2011), conventional E-learning is an instructional approach incorporating dialogue, interaction and communication into the learning process without visual presence. Rodríguez (2022)

noted that higher education institutions grappling with the exigencies of the COVID-19 pandemic turned to computerized methods for educational continuity.

This transition to digital methods aimed to ensure the continuity of education amid disruptions caused by the pandemic. The shift included the widespread implementation of various e-learning strategies and technologies. Nonetheless, this shift presented numerous challenges. El-Seoud et al. (2014) and Rodríguez (2022) pinpointed the arduous task of motivating and inspiring learners as a prominent issue associated with conventional e-learning. The dearth of direct personal interaction between students and instructors complicates the assessment of inspiration levels for online learners, introducing intricacies to the educational landscape in this context.

To address these challenges, Hsu et al. (2021) suggested that hybrid education and learning settings should be implemented, allowing virtual interaction without physical proximity, thus complementing physical presence. Beqiri et al. (2021) recommended that instructor interaction positively affect students' engagement in online learning environments. Furthermore, Dasgupta and Lin (2021), Hsu et al. (2021) and Liu et al. (2021) highlighted that incorporating active learning strategies, such as gamification and collaborative learning can significantly enhance students' learning outcomes in online courses. Additionally, Liu et al. (2021) posited that peer feedback is crucial in learning. Peer feedback can foster online collaborative learning by promoting active learning, social interaction and critical thinking.

Holograms in Education

The second category of research revolves around using holograms in various domains. According to Huang and Huang (2020), a hologram is a three-dimensional (3D) virtual representation of an object or person created using holographic technology. Unlike traditional two-dimensional images, holograms provide a more immersive and realistic experience by capturing depth and spatial information. According to Yoo et al. (2022), museums and cultural content use holograms for display. In education, holograms can facilitate virtual meetings between instructors and learners, allowing them to interact without the limitations of physical distance. Moreover, holograms can enhance the visualization of intricate concepts. For instance, a

holographic representation of a molecule can aid students in comprehending its three-dimensional structure and properties, leading to a better understanding and retention of complex concepts. Muhamad et al. (2019) found that students taught using holograms had better conceptual understanding than those who received conventional instruction. Holograms are also believed to increase student engagement and interest, as they create an immersive learning experience that captures learners' attention and motivates them to learn (Kalansooriya et al., 2015).

Huang et al. (2020) reported that students taught using holographic displays were more motivated to learn than those who received conventional instruction. Additionally, holograms can offer a more interactive and flexible learning experience by providing simulations that allow students to manipulate virtual objects and observe their behavior, thus enhancing problem-solving skills. Nazir et al. (2021) found that students taught using holographic simulations had better problem-solving skills than those who received conventional instruction.

The Impact of Technology on E-Learning

The third category of literature focuses on the impact of technology on E-learning. According to Jin and Liu (2021), several factors affect students' satisfaction with online learning, including teacher presence, course design and technological support. Using sophisticated technology can enhance the learning process, making learners feel engaged. Jin and Liu (2021) and Kocdar et al. (2021) emphasized the importance of interactions in online learning, highlighting various types of interactions, such as learner-learner and learner-instructor, which can positively affect online learners. Using sophisticated technology can enhance the learning experience and increase students' engagement. Similarly, Kocdar et al. (2021) emphasized the importance of interactions in online learning, such as learner-learner, learner-instructor and learner-content interactions, which can positively affect learning outcomes. Advanced technology can also address the challenges associated with E-learning, as suggested by Limbu and Yun (2021), who highlighted the role of self-regulated learning strategies and technology in improving academic achievement. Furthermore, Oztok and Brett (2021) suggested that instructor presence is essential for effective online learning.

Despite technological advancements and their potential to enhance E-learning, there remains a significant gap in understanding how these technologies, particularly emerging tools like holograms, can effectively address the limitations and challenges identified in conventional e-learning methods. Existing research has focused on general impacts and interactions in online learning environments but has not sufficiently explored the benefits and challenges of integrating advanced technologies such as holograms in E-learning. This study investigates how hologram technology can enhance e-learning experiences, specifically in the context of practical-oriented disciplines.

Methodology

Design

The study utilized a convergent mixed-method, combining quantitative and qualitative approaches to investigate the effectiveness of e-learning platforms, particularly the integration of hologram technology in the Tanzanian tertiary education. The design is suitable for this study as it provides both measurable evidence and detailed insights into how hologram technology influences e-learning, capturing complex interactions and offering a nuanced view of its effectiveness in the Tanzanian context (Timans et al., 2019).

Population and Sampling

The study focused on tertiary education institutions in Tanzania, precisely 26 public institutions located in Dar es Salaam. Through purposive sampling method, the researchers selected two institutions from this group. The researchers selected these institutions because the National Council for Technical, Vocational Education and Training (NACTVET) recognize them and they offer science-related programs. In addition, the selected institutions are part of the East Africa Skills for Transformation and Regional Integration Program (EASTRIP) supported by the World Bank, which includes e-learning development among its initiatives. The selected institutes are the National Institute of Transport and the Dar es Salaam Institute of Technology. The academic staff selected were those who taught various modules and used E-learning platforms. This choice was necessary because e-learning platforms introduced by the EASTRIP project are still new and are not widely utilized in these two institutions. In Table 1, the researchers selected 14 widely used e-learning platforms for a comprehensive analysis.

Table 1: List of E-Learning Platforms

Name of the platform	Website
Moodle	https://moodle.org/
Canvas LMS	https://www.instructure.com/canvas/
Blackboard Learn	https://www.anthology.com/products/teaching-and-learning/learning-effectiveness/blackboard-learn
Google Classroom	https://classroom.google.com/
Schoology	https://www.schoology.com/
D2L Brightspace	https://www.d2l.com/
TalentLMS	https://www.talentlms.com/
Adobe Captivate Prime:	https://business.adobe.com/products/learning-manager/adobe-learning-manager.html
Litmos:	https://www.litmos.com/
Docebo:	https://www.docebo.com/
Cornerstone OnDemand	https://www.cornerstoneondemand.com/
Haiku Learning	https://www.haikulearning.co.uk/
Sakai:	https://www.sakailms.org/
The National Transport Learning Resource Centre (NTLRC)	https://www.nit.ac.tz/index.php/library/#

Source: Researcher (2023)

Instruments

Case Studies: The case study instruments involve the analysis of e-learning platforms, focusing on their roles in teaching, conducting tests, exams, assignments, and uploading notes. Metrics for evaluating these roles assess the alignment with the Competency-Based Education and Training (CBET) philosophy.

Interviews: Semi-structured interviews took place with key stakeholders, including educators, administrators and students. The interview guide gathered insights into the practical aspects of e-learning, challenges faced and perceptions of integrating the hologram technology.

Validity and Reliability

The researchers employed several rigorous methods to ensure the study's validity and reliability. Case study validity was enhanced by using multiple sources of evidence, including e-learning platform analyses, interviews and document reviews, which provided a comprehensive understanding of the platforms' roles and minimized biases. Interview

validity was secured through pre-testing the interview guide for clarity and relevance and by triangulating data from multiple interviewees to cross-verify findings. Reliability was achieved by implementing a structured data collection and analysis protocol, including standardized procedures and inter-coder reliability checks, where multiple researchers independently coded the qualitative data to ensure consistency. This comprehensive approach aligns with established research practices, enhancing the credibility and robustness of the study's results (Yegidis & Myers, 2013).

Statistical Treatment of Data

The study's statistical treatment included descriptive statistics to summarize platform usage frequencies and percentages. Qualitative data from interviews were analyzed using content analysis.

Ethical Considerations

Participants were provided with comprehensive information about the study, including its purpose, procedures and potential impacts, and their informed consent was obtained before data

collection. Participants were assigned unique identifiers to ensure anonymity; personal identifying information was not included in the data analysis. Confidentiality was maintained by securely storing all data in password-protected files and limiting access to authorized research personnel only. Data were reported in aggregate form to prevent the identification of individual participants. Access to data was restricted solely to the research team.

Results and Discussions

This section presents findings on integrating e-learning platforms in Tanzanian tertiary education, focusing on their alignment with the CBET framework. The analysis reveals that while all platforms supported teaching and note uploading, only 78.6% were used for tests and 50% for final exams. Notably, no platforms facilitated practical assignments, highlighting a significant gap. The findings suggest that advanced technologies, such as holograms, could address this gap by enhancing

practical and high-stakes assessments and aligning e-learning more closely with the CBET philosophy.

The analysis meticulously scrutinized 14 e-learning platforms, ensuring the representation of the entire population within the sample. Table 2 delineates the metrics encapsulating the paper's concept, emphasizing the CBET philosophy for tertiary education in Tanzania. Symbol (√) indicates applicable metrics while (x) signifies that the platform is not used for the specified metrics, as illustrated in Table 2. The central question addressed was the role of E-learning in tertiary education. To gather the information that formed the basis for concluding, the study employed the following inquiry:

Research Question 1: How do learning institutions use various e-learning platforms for teaching, conducting tests, final exams, practical assignments, non-practical assignments, and uploading notes?

Table 2: Roles Played by the E-Learning Platforms

Name of the Platform	Teaching	Conducting Tests	Conducting Final Exams	Conducting Practical Assignments	Conducting Non-Practical Assignments	Uploading Notes
Moodle	√	√	√	X	√	√
Canvas	√	√	√	x	√	√
Blackboard learn	√	√	x	x	√	√
Google Classroom	√	√	x	x	√	√
DITELMS	√	√	x	x	√	√
D2L Brightspace	√	√	x	x	√	√
TalentLMS	√	√	√	x	√	√
Adobe Captivate Prime	√	√	√	x	X	√
Litmos	√	√	√	x	√	√
Docebo	√	√	√	x	X	√
Cornerstone OnDemand	√	x	x	x	X	√
Haiku Learning	√	x	x	x	X	√
Sakai	√	√	√	x	√	√
The National NTLRC	√	√	x	x	√	√
Frequency (Used)	14	11	7	0	10	14
%(Used)	100%	78.6%	50%	0%	71%	100%
Frequency (Not Used)	0	3	7	14	5	0
%(Not Used)	0%	21.4	50%	100%	36%	0%
Total	100%	100%	100%	100%	100%	100%

Source: Researcher (2023)

The research question led to the development of several specific questions, carefully designed to

encapsulate the overall concept and objectives of the study. These questions were then distributed

across various aspects relating to the use of E-learning. These aspects include using E-learning for Teaching, Conducting Tests, Conducting Final Exams, Conducting Practical Assignments, Conducting Non-Practical Assignments and Uploading Notes, as summarized in Table 2.

The results presented in Table 2 indicate the roles played by various e-learning platforms in Tanzanian tertiary education, focusing on the Competency-Based Education and Training (CBET) philosophy. The roles considered include teaching, conducting tests, conducting final exams, conducting practical assignments, conducting non-practical assignments and uploading notes. The platforms assessed in the study are Moodle, Canvas, Blackboard Learn, Google Classroom, DITELMS, D2L Brightspace, TalentLMS, Adobe Captivate Prime, Litmos, Docebo, Cornerstone OnDemand, Haiku Learning, Sakai and the National Transport Learning Resource Centre (NTLRC).

Teaching Aspect

The study aimed to gather information on using E-learning platforms in tertiary institutions, specifically focusing on their use in teaching activities. The following research question guided:

Research Question 1: How do institutions of learning utilize e-learning platforms to deliver course content and lectures?

Results show that 100% of platforms apply for teaching. This indicates that all the e-learning platforms under consideration are actively utilized as teaching tools in tertiary education. This aligns with the fundamental role of e-learning platforms in delivering educational content and facilitating the learning process. The 100% utilization of e-learning platforms for teaching underscores these technologies' pivotal role in delivering educational content within tertiary institutions. This finding aligns with the fundamental purpose of e-learning platforms as dynamic tools, facilitating the learning process in higher education. Several studies have consistently emphasized the transformative impact of e-learning on teaching methodologies, highlighting its ability to transcend traditional boundaries and offer innovative approaches to instructional delivery (Limbu & Yun, 2021). As supported by existing literature, the widespread adoption of e-learning platforms for teaching indicates their adaptability and efficacy in

disseminating educational materials to a diverse student population (Rodríguez et al., 2022).

E-learning platforms serve as virtual classrooms, offering a digital space where educators can engage students with multimedia resources, interactive content and collaborative tools. Their multifaceted nature allows diverse teaching strategies, catering to various learning styles and preferences. In addition, the 100% utilization rate emphasizes the ubiquitous presence of E-learning in educational institutions, suggesting that these platforms have become integral components of the modern teaching landscape.

Moreover, the comprehensive integration of e-learning platforms for teaching aligns with the global trend towards digitalization in education. The shift from traditional, face-to-face instruction to online teaching has been accelerated by the advancements in ICT (Hsu et al., 2021). The 100% usage rate signifies the prevalence of e-learning platforms and their acceptance as fundamental tools for instructional delivery in Tanzanian tertiary institutions.

As technology intertwines seamlessly with pedagogy, the literature surrounding e-learning becomes a rich tapestry of insights and innovations (Rodríguez et al., 2022). The unanimous reliance on e-learning platforms for teaching in Tanzanian tertiary education suggests that educators recognize the potential of these tools to enhance the overall quality and accessibility of education. The positive correlation between e-learning and student engagement, interaction, and access to resources further validates the critical role of these platforms in modern teaching practices (Limbu & Yun, 2021). The 100% utilization of e-learning platforms for teaching reflects their integral role in transforming educational practices in Tanzanian tertiary institutions. This alignment with global trends and the positive correlation with enhanced student engagement highlights the significance of these platforms as versatile and practical tools for instructional delivery in the ever-evolving landscape of education.

Conducting Tests Aspect

The guiding research question under the conducting tests aspect is as follows:

Research Question 2: In what ways do learning institutions use e-learning platforms to administer quizzes and tests?

The utilization of e-learning platforms for conducting tests, as indicated by 78.6% of platforms, underscores the widespread practice of incorporating assessment components into digital learning environments. This aligns with contemporary pedagogical approaches that emphasize the importance of ongoing evaluation to gauge students' comprehension and progress. The variety of evaluative measures, including quizzes and exams, display the flexibility of e-learning platforms in accommodating diverse assessment formats. Studies, such as those conducted by El-Seoud et al. (2014) and Rodríguez et al. (2022) recognized the challenges associated with motivating and inspiring online learners, emphasizing the need for effective assessment strategies to ensure sustained engagement.

During an interview, a researcher asked a respondent about the benefits they experienced when using the E-learning platform in conducting tests. During the interview, the respondent shared insightful comments about the advantages of using e-learning platforms. The respondent replied,

I prefer conducting tests using E-learning because it expedites the assessment process. The E-learning platform automatically marks and extracts scores for each student in a particular exam. This feature is extremely useful when there is a high enrollment of students in a specific program, as it significantly alleviates the workload of grading for a large student population in classes.

The prevalence of e-learning platforms for tests, reported by 78.6% of surveyed platforms, reflects the widespread integration of assessment components into digital learning environments. This aligns with contemporary pedagogical principles, emphasizing continuous evaluation for understanding students' comprehension and progress. The flexibility of e-learning platforms, evident in their diverse evaluative measures like quizzes and exams, underscores their adaptability to various assessment formats.

Studies by El-Seoud et al. (2014) and Rodríguez et al. (2022) acknowledge challenges in motivating online learners, highlighting the crucial role of effective assessment strategies in sustaining engagement. The user's perspective on preferring E-learning for test administration provides valuable insights. The user emphasizes the efficiency gained through

automated marking and score extraction for each student, which is especially beneficial given large class sizes. This approach expedites the assessment process and bypasses the necessity to measure specific components crucial for CBET.

While acknowledging that final exams and practical assignments adequately evaluate some components, the user's preference for e-learning assessments underscores their efficiency in measuring specific aspects. This aligns with the broader aim of contributing to a more comprehensive evaluation strategy within the educational framework. The user's perspective, therefore, illuminates the practical advantages of E-learning in addressing challenges associated with assessment in large class settings and reflects the evolving landscape of educational practices.

Conducting Final Exams

The third question aimed to gather information on the utilization of E-learning platforms with a specific focus on their use in Final Examinations. The guiding research question was as follows:

Research Question 3: How do e-learning platforms facilitate the administration of final exams?

The use of e-learning platforms for conducting final exams, observed in 50% of platforms, indicates a significant role in the summative assessment of students' overall understanding and competency. This functionality highlights the adaptability of e-learning platforms to meet various evaluation needs. Incorporating final exams in digital formats aligns with the evolving landscape of higher education during the COVID-19 pandemic, where virtual assessments became crucial for ensuring the continuity of teaching and learning (Rodríguez et al., 2022). However, the 50% utilization rate suggests that there may still be room for further improvement of these platforms into high-stakes assessments. One of the interview's interesting observations was as follows: "Beyond limited question types such as multiple-choice and true/false, there are additional concerns, including the potential for cheating, a lack of environmental control and a limited assessment of critical thinking."

The observation regarding the limited use of diverse question types in e-learning platforms (50% utilization) echoes the findings of Rodríguez et al. (2022). The concerns raised, including potential cheating and limited critical thinking assessment.

This further aligns with another study on e-learning challenges. To address this challenge, integrating varied question formats, implementing robust security measures and leveraging technologies for higher-order thinking are essential (French et al., 2023). This highlights the need for further exploration and optimization in integrating e-learning into high-stakes assessments.

Conducting Practical Assignments

The fourth question aimed to gather information on the utilization of E-learning platforms with a specific focus on their use in Conducting Practical Assignment activities. The following research question guided:

Research Question 4: What role do e-learning platforms play in the execution and supervision of practical assignments?

The absence of e-learning platforms for conducting practical assignments (0%) raises concerns about the current limitations in facilitating hands-on, experiential learning in a virtual environment. This finding implies that, at present, e-learning platforms may not adequately support the execution and assessment of practical tasks. To address this limitation, integrating immersive technologies, such as holograms, as suggested in the conceptual framework, could offer a solution to bridge the gap between theoretical knowledge and practical application.

Conducting Non-Practical Assignments

The fourth question aimed to gather information on the utilization of E-learning platforms, specifically their use in conducting practical assignment activities. The following research question guided:

Research Question 5: How are non-practical assignments (such as essays and research papers) managed and submitted through e-learning platforms?

With 64% of platforms being utilized for conducting non-practical assignments, there is a clear emphasis on the conventional use of e-learning platforms for theoretical and knowledge-based tasks. The prevalence of non-practical assignments aligns with the traditional online learning paradigm, where theoretical understanding is often prioritized. However, the need for a balanced approach that incorporates practical elements to ensure holistic learning experiences is underscored.

Uploading Notes

The next concern aimed to gather information on the utilization of E-learning platforms, specifically in assessing how learning materials are shared. This was guided by the following research question:

Research Question 6: How do e-learning platforms support the distribution of lecture notes and other course materials?

The universal use of e-learning platforms for uploading notes (100%) accentuates their crucial role in providing access to educational materials. This feature aligns with the principles of flexible learning, enabling students to revisit lecture materials at their convenience. The significance of easy access to notes is reinforced by the broader literature on technology in education, emphasizing the importance of learning anytime and anywhere (Kalansooriya et al., 2015).

The study demonstrates a 100% utilization of e-learning platforms for teaching and uploading notes, indicating their effectiveness. However, assessment challenges emerge, with 0% usage for practical assignments. This suggests a potential limitation in evaluating hands-on skills, highlighting the need for innovative solutions, such as holographic technology, to enhance assessments in the digital learning environment. This requires a separate discussion, as shown below:

In the context of Tanzanian tertiary education, aligning E-learning with the Competency-Based Education and Training (CBET) approach is essential for ensuring that learners acquire the necessary knowledge, skills, understanding and broader attributes specified by the National Technical Awards (NTA) level. The conventional e-learning methods, which involve teaching and uploading notes, have proven effective in delivering theoretical content. However, assessments present a significant challenge in evaluating learners comprehensively. The assessment encompasses four components, as delineated in the conceptual framework:

Assessing Knowledge and Understanding

Assessing knowledge and understanding is a fundamental component of the CBET system. Formal examinations are a standard method to test learners' theoretical knowledge. While online assessments can be utilized for this purpose, preventing cheating is crucial to maintaining the integrity of the evaluation process. Various studies,

including El-Seoud et al. (2014) and Rodríguez et al. (2022) emphasized the need for effective assessment strategies in online learning environments. Incorporating robust anti-cheating measures, continuous evaluation methods and diverse assessment formats can ensure the accuracy and reliability of assessing knowledge and understanding in an e-learning setting.

Assessing Skills and Wider Attributes

Assessing skills and broader attributes poses unique challenges in the e-learning landscape, particularly with conventional methods that rely on the physical presence of a trainer. However, the integration of holograms into E-learning has the potential to revolutionize the assessment of skills. Field Practical Training or practical sessions the module instructor operates are integral to evaluating learners' skills. The limitations of conventional e-learning, where physical presence is mandatory, can be mitigated through holographic technology.

Studies, such as those conducted by Yoo et al. (2022) and Muhamad et al. (2019), demonstrated the effectiveness of holograms in various educational domains. Holograms offer telepresence, allowing learners to virtually see and interact with their instructor as if they were physically present. The lifelike 3D representation of the instructor, projected into the classroom or viewed remotely, creates an immersive and interactive learning experience. This addresses the challenges associated with evaluating skills in a virtual environment and provides a solution to the limitations.

Conclusions and Recommendations

The study concludes that the platforms are crucial in delivering content and in teaching, uploading lecture notes and administering tests. However, the use of technology in final examinations and practical assignments indicate notable gaps that need addressing. It requires advanced technologies such as holograms, which can enhance the capacity of e-learning platforms and effectively support practical and hands-on learning experiences. Addressing these gaps will require technological advancements and continuous professional development for academic staff to optimize the use of e-learning platforms and ensure they meet the comprehensive needs of modern education. This holistic approach will strengthen the alignment of e-learning practices with the CBET framework, fostering a more effective and inclusive learning environment.

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