Human-Computer Interaction (HCI) Factors Influencing Students' Engagement with E-Learning Platforms in Public Universities in Southwestern Nigeria

[*1]Adebayo Monsur ISHOLA, PhD
Tai Solarin Federal University of Education, Ijagun, Ogun State, Nigeria
isholaam@tasued.edu.ng / 07059209901
ORCID: https://orcid.org/0000-0002-9747-4098

&

[2]Tomi OGUNDIPE, PhD
University of Ibadan, Ibadan, Oyo State, Nigeria
t.ogundipe@ui.edu.ng / 08166299570

Correspondence:
[1]Adebayo Monsur ISHOLA, PhD,
Department of Educational Technology,
College of Specialised and Professional Education,
Tai Solarin Federal University of Education, Ijagun, Ogun State, Nigeria.

DOI: https://doi.org/10.5281/zenodo.21719121

ABSTRACT
The study examined Human-Computer Interaction (HCI) factors influencing students' engagement with e-learning platforms in public universities in southwestern, Nigeria. It was guided by five (5) null hypotheses. A descriptive survey research design was used. The population comprised 2,421 Educational Technology undergraduates of Tai Solarin Federal University of Education, (TASFUED) Ijagun, Ogun State, and Adekunle Ajasin University (AAUA). A total of 470 Educational Technology undergraduates were selected using stratified sampling technique. A self-researchers-designed instrument tagged Human-Computer Interaction (HCI) factors and Students' Engagement with E-Learning Platforms Questionnaire (HCIFSEELQ) with 0.78 as reliability coefficient for data collection. Inferential statistics of regression analysis was used for testing the hypotheses at 0.05 significance level. The findings of the study showed that there was a positive and significant influence of usability-factor ($\beta = 0.164$, $t = 2.824$, $P < .05$), interactivity-factor ($\beta = 0.200$, $t = 3.465$, $P < .05$), user experience-factor ($\beta = 0.652$, $t = 4.883$, $P < .05$), cognitive-factor ($R = 0.93$, $p < .05$). and accessibility-inclusivity-factor ($\beta = .100$, $t = 2.227$, $P < .05$) on students' engagement with e-learning platforms in public universities. The study recommended that ensure the interface is simple, consistent, and easy to navigate so users can focus on learning rather than troubleshooting. Use interactive elements such as polls, quizzes, simulations, and games to keep students actively engaged rather than passively consuming content.

Keywords: Human-Computer Interaction (HCI), Students' Engagement, E-learning Platforms, Public Universities

INTRODUCTION

Student engagement with e-learning platforms in public universities involves active interaction with digital tools (like multimedia, forums, quizzes) and instructors/peers, driven by factors like perceived usefulness, ease of use, motivation, and sufficient resources (internet, devices), impacting learning outcomes, though challenges like isolation and technical hurdles persist, requiring interactive design and strong support to foster deeper cognitive and emotional investment beyond just basic participation. This engagement can take the form actively engaging with materials through reading, simulations, and assignments to build understanding; receiving timely feedback and guidance from lecturers; collaborating and discussing with peers, fostering social learning and diverse perspectives; measured by actions like video views, forum posts, and assignment completion as well as deeper investment, curiosity, and interest in the material, moving beyond just completing tasks (Miya & Govender, 2022).

It has been claimed that the use of multimedia, interactive elements, gamification, and personalization, reliable internet, suitable devices (mobile learning are key, belief that the platform is useful (usefulness) and easy to use (ease of use), adequate instructor support and a strong virtual community and internal drive and belief in one's ability to succeed were among determinants for student engagement with e-learning platforms (Giraldi *et al*, 2023). In the opinions of Miya and Govender (2022), it has been found that Human-Computer Interaction (HCI) may be among the factors that boosts student engagement in e-learning by creating intuitive, accessible, and enjoyable platforms through user-centered design, interactive elements like gamification and simulations, personalized feedback, and features supporting active learning and collaboration, ultimately reducing frustration and improving focus on learning content. Effective HCI makes complex platforms easy to navigate, caters to diverse learning styles, and promotes motivation, transforming students from passive receivers to active content creators. Human-Computer Interaction (HCI) factors influencing student engagement on e-learning platforms center on usability, interactivity, user experience, cognitive factors and accessibility-inclusivity.

In Human-Computer Interaction (HCI), e-learning usability for students means designing digital platforms so they are effective, efficient, and satisfying, allowing students to focus on learning, not using the software; it involves easy navigation, clear content, engaging interactions, and accommodating diverse learning styles to boost comprehension, retention, and motivation, preventing frustration and dropout. In this situation, students can successfully complete learning tasks (e.g., quizzes, finding resources, submitting assignments). Usability in Human-Computer Interaction (HCI) is vital for e-learning students as it directly improves the overall learning experience, leading to enhanced effectiveness, efficiency, and satisfaction. This, in turn, boosts student engagement, motivation, and ultimately, academic success. Also, usability in HCI (Human-Computer Interaction) boosts student engagement in e-learning by making platforms intuitive, efficient, and enjoyable, so students focus on learning content, not struggling with the interface, reducing frustration and increasing satisfaction, leading to better interaction, content retention, and self-directed learning through clear navigation, personalized experiences, and engaging interactive elements (Oyetade et al., 2023).

In e-learning, interactivity in HCI (Human-Computer Interaction) means designing platforms where students actively engage with content, instructors, and peers through features like quizzes, simulations, forums, and personalized feedback, moving beyond passive viewing to foster deeper understanding, motivation, critical thinking, and better learning outcomes by making

learning enjoyable and relevant. It's about creating a responsive, user-friendly digital environment that supports the user's learning journey. Interactivity in Human-Computer Interaction (HCI) offers numerous benefits for students using e-learning platforms, primarily by enhancing engagement, improving knowledge retention, and providing immediate feedback. Interactivity transforms students from passive observers into active participants in the learning process. Features like clickable diagrams, drag-and-drop exercises, and simulated labs make learning more interesting and less monotonous, which in turn significantly increases student motivation to complete courses (Yuvasri, 2024).

HCI Tech's e-learning platforms for students, such as the HCI Foundation Academy and those built on Microsoft Dynamics 365 services for higher education, emphasize a user-centric experience focused on accessibility, flexibility, and practical, skills-based learning. The core user experience (UX) is designed to be intuitive and engaging to maximize learning outcomes and knowledge retention. Also, as part of HCI factors, a good user experience (UX) in an e-learning platform, guided by principles of Human-Computer Interaction (HCI), offers significant benefits for students, including enhanced engagement, improved knowledge retention, and higher course completion rates. Intuitive, visually appealing interfaces, and the incorporation of interactive elements like quizzes and gamification, prevent boredom and frustration, which keeps students actively involved and motivated to continue their learning journey. A seamless UX minimizes "cognitive load" (the mental effort required to use the platform), allowing students to focus their attention on the educational content itself, rather than struggling with navigation or functionality issues (Shaidah et al., 2025).

Cognitive factors in Human-Computer Interaction (HCI) for e-learning platforms are the mental processes (attention, memory, perception, and problem-solving) that influence how students interact with the system and how effectively they learn. The primary goal is to design interfaces that align with human cognitive architecture to optimize learning and avoid mental overload. The mental effort imposed by the interface design itself, which is not essential to the learning goal (e.g., cluttered screens, confusing navigation, unnecessary graphics). This load should be minimized through clean, intuitive, and consistent design to allow learners to focus on the content. Integrating cognitive factors in Human-Computer Interaction (HCI) into e-learning platforms primarily benefits students by optimizing mental processes like attention, memory, and problem-solving, which in turn significantly boosts their engagement, satisfaction, and academic performance (Almaiah et al., 2020).

In Human-Computer Interaction (HCI), accessibility and inclusivity in e-learning platforms mean designing systems that are usable by all students, regardless of their diverse physical, cognitive, or situational abilities, to foster maximum engagement and equal opportunity. By removing barriers and providing flexible options, HCL design (Human-Centered Learning, an application of HCI in education) directly improves engagement. According to Elumalai et al. (2020), the benefits of accessibility-inclusivity in Human-Computer Interaction (HCI) within e-learning platforms significantly boost student engagement by addressing diverse needs and creating a more equitable learning environment. Providing well-structured content, high contrast visuals, and captions makes material easier to understand for everyone, including students in noisy environments or those who are second-language learners. Students feel valued when the platform is designed with their specific needs in mind, rather than feeling like an afterthought. This psychological safety encourages active participation and collaboration and that when accessibility is seamlessly

integrated, it normalizes diverse learning styles and needs, reducing any potential stigma associated with using assistive technologies or specific features (Elumalai et al., 2020).

Statement of the Problem

Student engagement in e-learning offers numerous benefits, leading to improved academic success, enhanced career readiness, and greater flexibility for learners. Engaged students are more motivated, involved, and likely to achieve their educational goals. However, in Nigeria universities, students in public universities face significant problems with e-learning engagement, largely due to inadequate technical infrastructure, lack of social interaction and isolation, and student-specific factors like time management and self-motivation. These issues often lead to a feeling of disconnection and reduced participation. This led to the poor student e-learning engagement in public universities which has a multiplier effect, where initial negative impacts trigger a cascading series of compounding problems that ultimately degrade the overall quality of education, strain university resources, negatively impact the broader society, lack of motivation, poor infrastructure) which lead to immediate consequences, that in turn worsen other aspects of the educational system and beyond. Thus, this study therefore seeks to examine how Human-Computer Interaction (HCI) factors influence students' engagement with e-learning platforms in public universities in southwestern, Nigeria.

Objectives of the Study

The main objective of the study was to examine Human-Computer Interaction (HCI) factors influencing students' engagement with e-learning platforms in public universities in southwestern, Nigeria. Specifically, the study sought to:

1. find out the influence of usability-factor on students' engagement with e-learning platforms in public universities;
2. examine the influence of interactivity-factor on students' engagement with e-learning platforms in public universities;
3. ascertain the influence of user experience-factor on students' engagement with e-learning platforms in public universities;
4. determine the influence of cognitive-factor on students' engagement with e-learning platforms in public universities;
5. find out the influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities.

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

$H_0$1: There is no significant influence of usability-factor on students' engagement with e-learning platforms in public universities.

$H_0$2: There is no significant influence of interactivity-factor on students' engagement with e-learning platforms in public universities.

$H_0$3: There is no significant influence of user experience-factor on students' engagement with e-learning platforms in public universities.

$H_0$4: There is no significant influence of cognitive-factor on students' engagement with e-learning platforms in public universities.

$H_0$5: There is no significant influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities.

Theoretical Framework

Self-Determination Theory (SDT)

Self-Determination Theory (SDT) was propounded by psychologists Edward Deci and Richard Ryan in 1985. Self-Determination Theory (SDT) is a framework for understanding human motivation, personality, and well-being, proposing that people are inherently driven to grow, but need social support to thrive, particularly by satisfying psychological needs: autonomy (choice/control), competence (mastery) relatedness (connection/belonging).

When these needs are met, individuals experience higher-quality motivation (intrinsic and autonomous), leading to better performance, health, and fulfillment; when thwarted, motivation becomes controlled and less effective, impacting well-being. Also, Self-Determination Theory (SDT) explains e-learning engagement through three innate psychological needs: Autonomy (choice/control), Competence and Relatedness (connection/belonging); when e-learning environments support these needs (e.g., offering choices, providing clear feedback, fostering community), students feel intrinsically motivated, leading to deeper engagement, better outcomes, and a stronger sense of self-direction.

Furthermore, the theory stated that allowing students to choose project topics, select assignment deadlines (within reason), or pick learning paths, rather than rigid, one-size-fits-all modules and that providing scaffolding, constructive feedback, clear instructions, opportunities for practice, and challenges that build skills, leading to a sense of accomplishment as well as facilitating group projects, discussion forums with active instructor participation, virtual social events, or peer-to-peer feedback systems. When these needs are met, students are more likely to learn for inherent interest (intrinsic motivation) rather than just external rewards, fostering deeper engagement. Online settings, lacking physical cues, must intentionally design for these needs; otherwise, students can feel isolated (low relatedness) or adrift (low autonomy/competence). Educators support these needs through autonomy-supportive teaching, providing structure (for competence), and showing involvement (for relatedness). Thus, by applying SDT, e-learning platforms move beyond simple content delivery to create environments that nurture psychological growth, making students active, motivated participants.

Relevance of the theory to the study

Self-Determination Theory (SDT) is highly relevant to e-learning via HCI as it explains engagement through satisfying students' innate needs for Autonomy, Competence, and Relatedness, guiding designers to create user interfaces (HCI) that offer choice, build mastery, and foster connection, thereby increasing intrinsic motivation and sustained participation in online learning. HCI design elements like interactive tools (mind maps, real-time comments) support these needs, transforming passive learning into active, self-driven engagement. Instead of just delivering content, HCI uses features like adjustable content, interactive elements (videos, images), and feedback mechanisms to directly address autonomy (choice), competence (mastery), and relatedness (connection). SDT helps explain the shift from external control (extrinsic

motivation) to self-driven learning (intrinsic motivation) in online settings, where less supervision can be a double-edged sword. SDT focuses on "functioning well" (eudaimonic well-being) rather than just "feeling good," guiding HCI to design for deep learning and resilience, not just fleeting enjoyment. SDT provides a framework to understand *why* certain HCI best practices (like interactive elements) work, linking them to basic psychological needs.

Methodology

A descriptive survey research design was used for the study. The population of this study comprised 2,421 Educational Technology undergraduates of Tai Solarin Federal University of Education, (TASFUED) Ijagun, Ogun State, and Adekunle Ajasin University (AAUA). For record purpose, TASFUED has a total 1246 and AAUA has 1175 undergraduates in Educational Technology. A total of 470 Educational Technology undergraduates of Tai Solarin Federal University of Education, (TASFUED), and Adekunle Ajasin University (AAUA) were selected as sample size using stratified sampling technique. However, 270 and 200 were selected from TASFUED and AAUA. A self-researchers-designed instrument tagged Human-Computer Interaction (HCI) factors and Students' Engagement with E-Learning Platforms Questionnaire (HCIFSEELQ) was used for this study. HCIFSEELQ used for the collection of data from the respondents on how usability-factor, interactivity-factor, user experience-factor, cognitive-factor and accessibility-inclusivity factor influence on students' engagement with e-learning platforms. The questionnaire requested responses on a four (4) – point scale format which was a modification of 5-point Likert scale. To ensure the face and content validity of the instrument, copies of the instrument were given to experts in the Department of Educational Technology, Tai Solarin Federal University of Education. Reliability test of the instrument was done using a test-retest method. In this case, copies of the instrument were administered twice on 15 Educational Technology undergraduates from Emmanuel Alayande University of Education, that were not part of the sample size within a week interval. The collected data from the dual administration of the instruments were compared using Pearson Product Moment Correlation (PPMC) and reliability coefficient was reported as 0.78. Primary method of data collection was used in this study. Primary method includes the usage of questionnaire to collect data from the identified respondents. However, an introduction letter was collected from the Head of Department, Department of Educational Technology, TASFUED presented to the case study area to show the researcher's mission and reasons for conducting the study. Inferential statistics of regression analysis was used for testing the hypotheses at 0.05 significance level.

Results

Presentation of Results

$H_0$1: There is no significant influence of usability-factor on students' engagement with e-learning platforms in public universities.

Table 1: Influence of usability-factor on students' engagement with e-learning platforms in public universities

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.725	2.479		14.006	.000
	usability-factor	.147	.052	.164	2.824	.005

a. Dependent Variable: students' engagement with e-learning platforms

Table 1 showed that the independent variables (usability-factor) was found to be significant and strongly influence dependent variable with the P-value less than 0.05 and magnitude of usability-factor ($\beta = 0.164$, $t = 2.824$, $P < .05$). The implication of this result was that null hypothesis was not true and the researchers concluded that there was a positive and significant influence of usability-factor on students' engagement with e-learning platforms in public universities.

$H_0$2: There is no significant influence of interactivity-factor on students' engagement with e-learning platforms in public universities.

Table 2: Influence of interactivity-factor on students' engagement with e-learning platforms in public universities

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	36.078	1.638		22.023	.000
	interactivity-factor	.346	.100	.200	3.465	.001

a. Dependent Variable: Students' engagement with e-learning platforms

Table 2 showed that the independent variables (interactivity-factor) was found to be significant and strongly determine dependent variable with the P-value less than 0.05 and magnitude of interactivity-factor ($\beta = 0.200$, $t = 3.465$, $P<.05$). This implied that null hypothesis was rejected and the researchers concluded that there was a positive and significant influence of interactivity-factor on students' engagement with e-learning platforms in public universities.

H$_0$3: There is no significant influence of user experience-factor on students' engagement with e-learning platforms in public universities.

Table 3: Influence of user experience-factor on students' engagement with e-learning platforms in public universities.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	39.381	2.632		14.960	.000
	user experience-factor	.347	.054	.652	4.883	.002

a. Dependent Variable: students' engagement with e-learning platforms

Table 3 showed that the independent variable (user experience-factor) was found to be significant and strongly determine dependent variable with the P-value less than 0.05 and magnitude of user experience-factor ($\beta = 0.652$, $t = 4.883$, $P<.05$). The implication of this result was null hypothesis was not true and the researchers concluded that there was a positive and significant influence of user experience-factor on students' engagement with e-learning platforms in public universities.

H$_0$4: There is no significant influence of cognitive-factor on students' engagement with e-learning platforms in public universities.

Table 4: Influence of cognitive-factor on students' engagement with e-learning platforms in public universities

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.93[a]	.89	.83	9.027382

a. Predictors: (Constant), cognitive-factor
b. Dependent variable: students' engagement with e-learning platforms

The table 4 showed that there was significant influence of cognitive-factor on students' engagement with e-learning platforms in public universities variable; $R = 0.93$, $p < .05$. This implied that null hypothesis was rejected and the researchers concluded that there was significant cognitive-factor on students' engagement with e-learning platforms in public universities. The table further revealed about 89% variation in students' engagement with e-learning platforms was accounted for by explanatory variables (cognitive-factor)..

$H_0$5: There is no significant influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities.

Table 5: Influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	35.294	1.439		24.528	.000
	accessibility-inclusivity-factor	.114	.051	.100	2.227	.026

a. Dependent Variable: students' engagement with e-learning platforms

Table 5 showed that the sign of the coefficient of accessibility-inclusivity-factor is positive which implied that an increase or improvement in it will increase dependent variable. The independent variables were found to be significant and strongly determine students' engagement with e-learning platforms with the P-value less than 0.05 and magnitude of accessibility-inclusivity-factor (β = .100, t = 2.227, P < .05). Thus, null hypothesis was not true and that there was there was a positive and significant influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities.

Discussion of Findings

The findings of the study showed that there was a positive and significant influence of usability-factor on students' engagement with e-learning platforms in public universities. These findings were in consonant with Ishola et al. (2022) who found that usability factors act as direct drivers of student engagement and academic success in public universities. they further averted that poor usability leads to user frustration, disengagement, and high dropout rates, while a well-designed, user-friendly interface fosters active participation, better comprehension, and increased retention of learning materials. Abuhlfaia and Quincey (2018) found that if students can quickly understand how to navigate the platform (e.g., Moodle, Blackboard) without complex training, they are more likely to use it regularly and that a steep learning curve causes frustration, leading to abandonment of the tool.

There was a positive and significant influence of interactivity-factor on students' engagement with e-learning platforms in public universities. These findings were corroborated with Aldraiweesh and Alturki (2025) that interactivity-factor in e-learning refers to the level and quality of engagement between learners, instructors, content, and the technology platform itself. Alebeisat et al. (2023) that in public universities, where class sizes are often large and resources constrained, a high interactivity-factor is crucial for boosting student motivation, active participation, and academic achievement. This factor transforms passive learning into an active experience, reducing student isolation and improving retention of course material.

There was a positive and significant influence of user experience-factor on students' engagement with e-learning platforms in public universities. These findings were in tandem with Asel et al. (2019) noted that user experience (UX) is a critical determinant of student engagement with e-learning platforms in public universities, influencing how students interact with, adopt, and derive value from online learning tools. Almaiah et al. (2020) agreed that a positive, user-centric design

increases motivation and satisfaction, while poor usability causes frustration, disengagement, and, in some cases, high dropout rates.

There was a positive and significant influence of cognitive-factor on students' engagement with e-learning platforms in public universities. The findings were in consonant with Elumalai et al. (2020) that cognitive factors refer to the mental processes, psychological investment, and intellectual effort that students apply to understand, process, and master course content within an e-learning environment. In public universities, where resources might be constrained and classes large, cognitive engagement driven by internal motivation and self-regulation is arguably the most critical predictor of academic success in online learning.

There was a positive and significant influence of accessibility-inclusivity-factor on students' engagement with e-learning platforms in public universities. These findings were in correlation with Miya and Govender (2022) who noted that the accessibility-inclusivity factor is a critical determinant of student engagement with e-learning platforms in public universities. When e-learning systems are designed to be accessible (compatible with assistive technologies, usable by all) and inclusive (catering to diverse needs, backgrounds, and abilities), student engagement increases, fostering equity, higher motivation, and better academic outcomes. Conversely, poor accessibility leads to frustration, alienation, and higher dropout rates for students, particularly those with disabilities or in low-resource settings.

Conclusion

This study examined Human-Computer Interaction (HCI) factors influencing students' engagement with e-learning platforms in public universities in southwestern, Nigeria and the following conclusions were drawn based on the findings of the study that usability-factor, interactivity-factor, experience-factor, cognitive-factor and accessibility-inclusivity-factor were positively influence students' engagement with e-learning platforms in public universities.

Recommendations

The following recommendations were raised in line with the findings of the study:

1. Replace passive viewing with interactive methods such as case-based problem solving, scenario-based learning, and simulations.
2. Set up virtual lounges or discussion boards for informal conversations (e.g., a "coffee break" forum) to help students feel connected to the university community.
3. Make sure all content is accessible on mobile devices, allowing students with limited access to computers to learn on the go.
4. Ensure the interface is simple, consistent, and easy to navigate so users can focus on learning rather than troubleshooting.
5. Optimize for smartphones and tablets to enable access for students who rely on mobile devices, ensuring touch-friendly interfaces and responsiveness.
6. Use interactive elements such as polls, quizzes, simulations, and games to keep students actively engaged rather than passively consuming content.

7. Incorporate discussion forums, group projects, and peer-to-peer collaboration tools to foster a sense of community and reduce feelings of isolation and use badges, points, and leaderboards to motivate students and encourage them to complete milestones.

References

Abuhlfaia, K., & Quincey, E. (2018). The usability of e-learning platforms in higher education: a systematic mapping study. Khaled Abuhlfaia Keele University School of Computing and Mathematics Staffordshire.

Aldraiweesh, A., & Alturki, U. (2023). Exploring factors influencing the acceptance of e-learning and students' cooperation skills in higher education. *Sustainability Journal, 15*, 1-22.

Alebeisat, F., Haroon, A., Zaid, T. A., Ali, Q., & Mohmmad, A. (2023). the impact of human and computer interaction on e-learning quality. Tafila Technical University, Tafila, Jordan.

Almaiah, M. A., Ahmad, A., & Althunibat, A. (2020). Exploring the critical challenges and factors finfluencing the E-learning system usage during COVID-19 pandemic. Education and Information Technologies, Springer.

Asela, A. G., Yukun, B., & Kibelloh, B. (2019). The role of usability on e-learning user interactions and satisfaction: a literature review. *Journal of Systems and Information Technology, 21*(2), 368-396.

Edward Deci & Richard Ryan (1985). Self-Determination Theory (SDT).

Elumalai, K. V., Jayendira, P. S., Kalaichelvi, R., Jeena, A. J., Nidhi, N., Mufleh, S. M. A., & May, A. A. (2020). Factors affecting the quality of e-learning during the covid-19 pandemic from the perspective of higher education students. *Journal of Information Education Technology, 19,* 732-752.

Giraldi, L. Giovannetti, M., & Cedrola, E. (2023). User experience on e-learning platforms in higher education. *Research Square Education Journal, 21(*7), 234-245.

Jehad, A. (2025). Assessing the usability of e-learning software among university students: A study on student satisfaction and performance. *International Journal of Information Technology and Web Engineering, 18*(1), 25.

Miya, T. K., & Govender, I. (2022). Research in business and social science. *International Journal of Research in Business and Social Science, 11*(10), 316-327.

Mohammed, A. A., Ahmad, A., & Ahmad, A. (2020). Exploring the critical challenges and factors influencing the e-learning system usage during COVID-19 pandemic. *Education and Information Technologies, 25*:5261–5280.

Murugan, K., & Yuvasri, S. (2024). A study on students' perception towards online classes. *International Journal of Applied Research, 10*(12), 233-239.

Oyetade, K. Harmse, A., & Zuva, T. (2023). Factors influencing students' use of e-learning technologies. *International Journal of Learning, Teaching and Educational Research, 22*(9), 617-632.

Ishola, A. M., Adelana, O. P., & Akorede, O. J. (2022). Perception of techno-stress among university undergraduates. *Journal of ICT in Education, 9*(2), 137-149.

Shaidah, J., Sufyan, A., & Abdelraheem, A. (2025). A study of user experience for e-learning using interactive online technologies. *Journal of Theoretical and Applied Information Technology, 97*(15), 4036-4047.

Yuvasri, K. M. (2024). A study on students' perception towards online classes. *International Journal of Applied Research, 10*(12), 233-239.