

PAPER

Evaluating User Experience in Learning Applications among University Students in Nigeria Using UEQ

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ABSTRACT

This study evaluates the user experience (UX) of learning applications among university students in Nigeria using the user experience questionnaire (UEQ). With the rapid shift toward digital and mobile learning platforms in higher education, understanding students' perceptions of usability, engagement, and overall satisfaction has become crucial. The study surveyed 397 university students to assess six key UX dimensions: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. The findings revealed that the learning management system (LMS) users have a positive experience with it and use it frequently. The novelty category, on the other hand, has the lowest moodle mean score. We posit that these results are acceptable since the student aims to access the LMS to learn. The findings provide valuable insights for educators, developers, and policymakers aiming to optimize e-learning applications for improved usability and engagement. This study contributes to the broader conversation on enhancing digital learning experiences in developing regions.

KEYWORDS

e-learning, user experience (UX), learning management system (LMS), user experience questionnaire (UEQ)

1 INTRODUCTION

In recent years, e-learning has emerged as a transformative approach in the educational landscape, leveraging information and communication technology (ICT) to facilitate the delivery of educational content and learning experiences. Central to the infrastructure of e-learning are learning management systems (LMS), which serve as comprehensive platforms for administering, documenting, tracking, reporting, and delivering educational courses and training programs. The effectiveness of e-learning heavily depends on these LMS platforms' usability and user experience (UX). High-quality UX ensures learners can navigate and utilize the systems efficiently, enhancing their overall learning experience and outcomes. Around the turn of the millennium, UX research was initiated on the grounds that usability research

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was overly preoccupied with task efficiency and labor [1]. The idea of usability extends its significance to the requirement of raising the caliber of goods and services, including information systems, in order to make consumers feel more at ease utilizing computer information systems [2]. Given the rapid shift to online learning due to global issues such as the COVID-19 pandemic, the importance of UX in LMS has become even more pronounced [3]–[5]. Therefore, evaluating UX in e-learning environments is crucial to understanding and improving student engagement, satisfaction, and performance. Comprehensive research in this area can provide valuable insights into optimizing LMS design and functionality to meet the needs of learners and educators better.

User experience is a critical factor in the effectiveness and success of learning applications, particularly in e-learning. Understanding the elements that impact UX in these applications is crucial for designing and implementing efficient educational technologies [6] and influencing teaching and learning processes [4]. Recent research has highlighted the factors affecting the continuance intention of mobile-assisted language learning applications, providing insights into user intention and technology adoption in language learning [6]. This emphasizes the importance of exploring user behaviors and preferences to enhance learning applications' usability and overall experience. Studies have demonstrated that system, information, and service quality positively affect user satisfaction in distance learning, further highlighting these factors' significance in optimizing learning platforms' effectiveness [7]. Additionally, analyses of student satisfaction with online video conference applications based on usability criteria emphasize the need for developers to prioritize user satisfaction and understand the factors influencing it for the continuous success of e-learning applications [8].

The creation of a UX key performance indicator (KPI) based on the user experience questionnaire (UEQ) highlights the multifaceted nature of UX, encompassing aspects such as ease of learning, efficiency, aesthetics, joy-of-use, novelty, and attractiveness [9]. Evaluating UX in integrated learning information systems using the UEQ method further stresses the significance of dependability, novelty, and other factors in shaping user perceptions and interactions with educational platforms [10]. Moreover, applying the UEQ in analyzing digital applications such as the Identitas Kependudukan Digital (IKD) application highlights the importance of optimal design to meet user requirements effectively [11]. Using the UEQ, researchers assess the level of UX in IKD applications, emphasizing the value of user-centered design in enhancing the usability and overall experience of learning applications. Additionally, measuring and evaluating UX in applications such as Microsoft Teams using frameworks such as UEQ+ demonstrates evolving methodologies to assess and enhance UX in educational technologies [6].

In e-learning, understanding the key factors influencing users' behavioral preferences is essential for tailoring learning experiences to meet diverse needs effectively [12]. This requires comprehensively exploring the factors shaping user preferences and behaviors in educational settings. Incorporating aspects of usability and UX, such as efficiency, insight, reliability, originality, and stimulation, highlights the holistic approach needed to design engaging and user-centric learning applications [13]. Hence, in this paper, we analyze university students' feedback on the UX of an available LMS to identify issues with the UX and usability of the LMS. We aim to answer the following question: "What factors influence the UX of university students while using an LMS?" via a quantitative research approach using the UEQ survey instrument developed by Laugwitz et al. [14], available at <https://www.ueq-online.org>. The remainder of this paper proceeds as follows. We begin by providing an overview of

the UEQ tool. We proceed by describing the methodology, then we give the results, discuss our findings and implications, and then we present our conclusions.

1.1 The user experience questionnaire

The UEQ is a valuable tool for assessing interactive product UX, providing a quick and accurate way to evaluate user perceptions and interactions with digital applications [15], [16]. The UEQ was designed based on Hassenzah's theoretical model [17]. This approach makes a distinction between a product's perceived hedonic quality, perceived ergonomic quality, and perceived attractiveness. The independent dimensions of UX are described by perceived hedonic quality and perceived ergonomic quality [1]. UX evaluation through the UEQ has been widely applied across various domains to assess and enhance the usability and effectiveness of interactive products and applications. Studies such as the evaluation of the "Halodoc" mobile health application [18] and the "Identitas Kependudukan Digital" application [11] have utilized the UEQ to measure UX dimensions such as attractiveness, efficiency, dependability, stimulation, and novelty. The UEQ has also been employed in assessing multimedia programs for teacher education [19] and mobile application designs [20], demonstrating its versatility in evaluating UX across different platforms. The findings from these studies have highlighted the importance of attractiveness, efficiency, dependability, stimulation, and novelty in shaping user perceptions and satisfaction.

The UEQ has been instrumental in evaluating systems like academic information platforms and e-learning platforms [20] and augmented reality systems [21], providing insights into user satisfaction and preferences. These evaluations have identified critical aspects of UX, including clarity, accuracy, and efficiency, contributing to the continuous improvement of interactive systems. Additionally, developing interactional models and quality analysis of UX in applications like social e-book reader underscores the importance of accommodating user habits and preferences in designing educational platforms [22]. Using standardized questionnaires such as the UEQ, researchers can gain insights into UX and make informed decisions that enhance the usability and effectiveness of learning technologies.

2 METHODOLOGY

This work aims to gain insights into factors affecting the UX of university students while using an LMS, both positively and negatively. This study uses primary data collected via a survey of undergraduate and graduate students at a private university in Southwest Nigeria. The survey spanned two months. The survey instrument was administered electronically using Google Forms and was adapted from the UEQ tool. The UEQ is a standardized questionnaire designed to measure users' perceptions and experiences of interactive products or services. It consists of six measures and 26 items that capture various dimensions of UX, including pragmatic qualities (efficiency, perspicuity, and dependability) and hedonic qualities (stimulation, novelty, and attractiveness). A comprehensive description of these measures can be found at www.ueq-online.org. The items of the UEQ are semantic differentials with a 7-point answer scale. They consist of a pair of terms with opposite meanings that span a semantic dimension.

The students interacted and engaged with moodle as the LMS by performing various tasks such as downloading lecture materials, submitting assignments, taking quizzes, and joining live classes. moodle is the world's most customizable and trusted eLearning solution that empowers educators to improve our world (www.moodle.com/about). It is an e-learning platform that makes quality online education accessible by providing multiple teaching and learning tools for educators and learners. The data collected were then analyzed following the established guidelines for administering, analyzing, and interpreting the UEQ data, available at www.ueq-online.org, to ensure the validity and reliability of our results.

3 RESULTS

Three hundred ninety-seven students participated in the survey (male = 40.3%, female = 59.7%) from three faculties at the university. Most respondents were teenagers and adults between 18 and 24 years (95%). The characteristics of our sample are shown in Table 1. The raw data from the surveys underwent rudimentary processing before the analysis commenced. The data was downloaded from an online form into excel spreadsheets, sorted, and transformed.

Data sorting is screening survey data to determine whether it is accurate or inaccurate. Data transformation involves flipping the data values. The participants' responses are graded on a “-3” to “+3” scale. If a participant replies “1” on the scale of a question, the question will receive a score of “-3,” and a response of “7” will receive a score of “3.” “-3” denotes the most negative response, “0” denotes a neutral response, and “+3” represents the most significant positive response. Users have a positive impression of this scale if the scale values are above “+1” and a negative impression if the scale values are below “-1.” The mean score of a question is calculated using the overall score of that question. The mean score of an item is determined using the average of all questions about that item. The mean of the scores is then used to determine the attribute's score. Figure 1 provides a visual representation of the total number of responses obtained from the survey. It shows each item's total number of responses, sectioned according to the levels presented.

Table 1. Sample characterization

Variable	Frequency	% Distribution
Gender		
Male	160	40.3%
Female	237	59.7%
Total	397	100.0%
Age		
15–24	377	95%
25–34	12	3%
35–44	6	1.5%
45 and above	2	0.5%
Total	397	100.0%

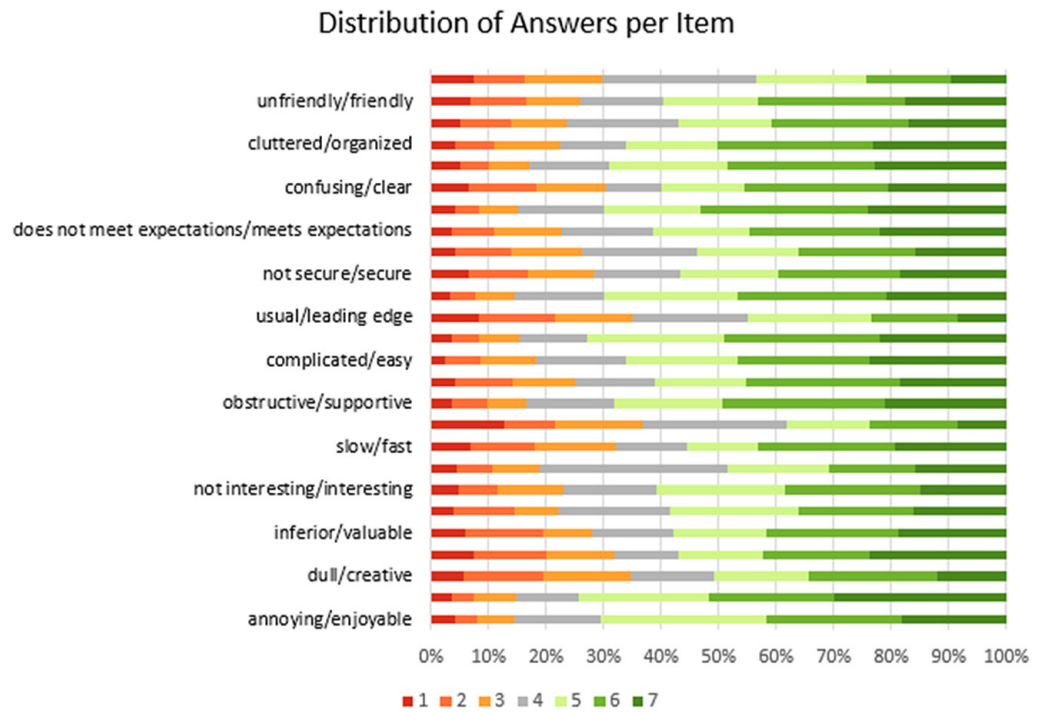


Fig. 1. Answer distribution per item

The 5% confidence intervals for the scale and single-item means are provided in Table 2. The confidence interval estimates the precision with which the scale mean is calculated. The smaller the confidence interval, the greater the estimation accuracy and the likelihood that the results can be trusted.

Table 2. Confidence intervals for UEQ scales

Confidence Intervals (p = 0.05) per Scale						
Scale	Mean	Std. Dev.	N	Confidence	Confidence Interval	
Attractiveness	0.930	1.117	397	0.110	0.820	1.040
Perspiciuity	0.932	1.260	397	0.124	0.808	1.056
Efficiency	0.980	1.206	397	0.119	0.861	1.098
Dependability	0.810	1.068	397	0.105	0.705	0.915
Stimulation	0.681	1.173	397	0.115	0.565	0.796
Novelty	0.185	1.041	397	0.102	0.082	0.287

The mean and variance for each of the scales were calculated and visualized. As seen in Figure 2, the **attractiveness** category obtains a mean score of 0.930, which falls within the positive assessment score range of 0.8 to three, the highest possible value. This means the respondents had a good impression of moodle; they liked using it. The **perspiciuity** scale earns a value of 0.980, indicating that it is once again rated positively. The **perspiciuity** scale earns the highest score of any other scale, indicating that the students found it easy to get familiar with and learn to use moodle. The **efficiency** scale got a positive mean score of 0.932, reflecting the students’ ability to solve tasks without unnecessary effort. The **dependability** scale earns a positive mean score of 0.810, indicating that the students felt in control

of their interactions. The **stimulation** category receives a positive mean score of 0.681, while the **novelty** scale earns a score of 0.185, which falls inside the neutral scoring zone.

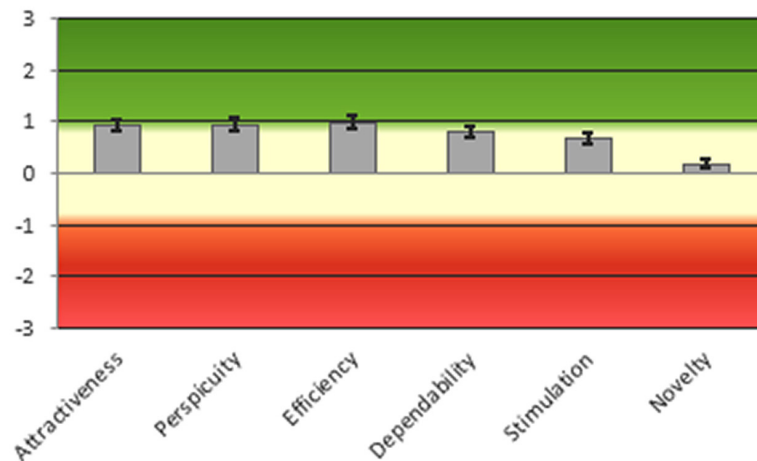


Fig. 2. UEQ scales analysis result

The findings revealed that moodle users have a positive experience with it and use it frequently. The novelty category, on the other hand, has the lowest moodle mean score. We posit that these results are acceptable since the student aims to access the LMS to learn.

3.1 Data benchmarking

Data benchmarking involves comparing the data received with the data from other surveys and providing a category for the result [16]. It is the first measure to determine the UX while interacting with the LMS, which may potentially influence acceptance and continuous usage intention. The result is divided into five categories by the benchmark.

1. Excellent: In the top 10% of all outcomes.
2. Good: 10% of the findings in the benchmark set are better, whereas 75% are worse.
3. Above average: The benchmark results are better than 25% of the data received, while 50% of the benchmark results are worse.
4. Below average: 50% of the benchmark outcomes are better than the data received, while 25% of the benchmark results are worse.
5. Bad: Approximately 25% of the poorest results.

As seen in Table 3 and Figure 3, the data received from the survey got a rating of “below average” in the attractiveness, perspicuity, efficiency, dependability, and stimulation scales. This implies that 50% of the results in the benchmark are better than the data received, and 25% of the data in the benchmark are worse than the data received. The novelty scale was classified as “bad,” implying that the data in the benchmark is 75% better than the data received. This analysis does not mean low data integrity; it only shows how it performs against the data obtained from several surveys.

Table 3. Benchmarking results of the UEQ scales

Scale	Mean	Comparison to Benchmark	Implication
Attractiveness	0.93	Below Average	50% of the benchmark outcomes are better, while 25% of the benchmark results are worse.
Perspicuity	0.932	Below Average	50% of the benchmark outcomes are better, while 25% of the benchmark results are worse.
Efficiency	0.98	Below Average	50% of the benchmark outcomes are better, while 25% of the benchmark results are worse.
Dependability	0.81	Below Average	50% of the benchmark outcomes are better, while 25% of the benchmark results are worse.
Stimulation	0.681	Below Average	50% of the benchmark outcomes are better, while 25% of the benchmark results are worse.
Novelty	0.185	Bad	Approximately 25% of the poorest results.

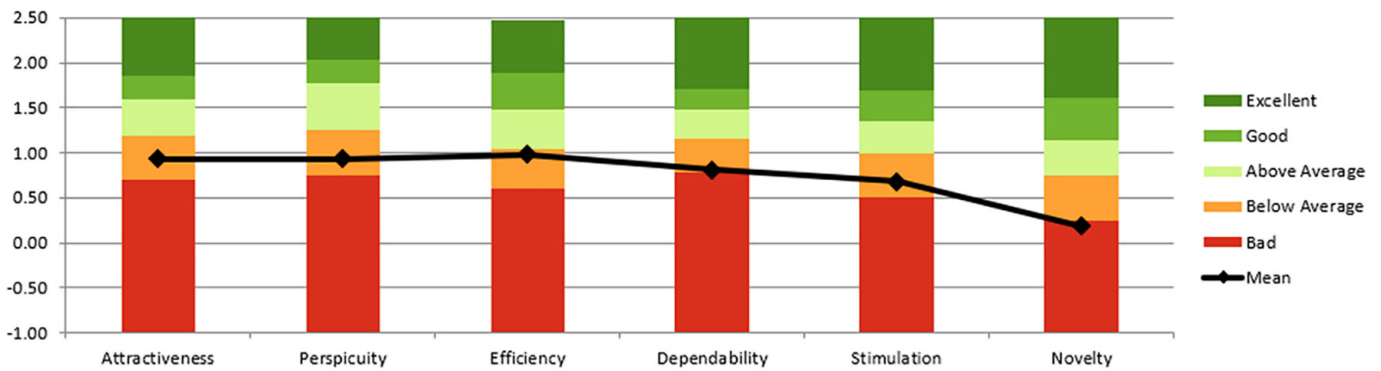


Fig. 3. Benchmarking graph of the UEQ scales

4 DISCUSSION

The evaluation of the UX of the LMS using the UEQ provides critical insights into the system’s performance and areas for enhancement. The results reveal that while most UEQ scales, including attractiveness, perspicuity, efficiency, and dependability, have positive mean scores greater than 0.8, the stimulation and novelty scales fall significantly behind with mean scores of 0.681 and 0.185, respectively. Furthermore, benchmarking results show that all scales fall below the average benchmark except for novelty, which is still rated poorly. These findings have important implications for the LMS, students, and other stakeholders involved in e-learning at a private university in southwest Nigeria. The student body at this university represents a diverse range of socioeconomic backgrounds, educational levels, and familiarity with digital technologies.

The generally positive mean scores above 0.8 for most scales indicate that students find the LMS functional and adequate regarding basic usability and design. This suggests that the LMS is perceived as attractive, easy to understand and use, efficient in completing tasks, and dependable in its performance. The lower scores in stimulation (0.681) and novelty (0.185) are particularly concerning. Stimulation measures how exciting and motivating the system is to use, and the low score indicates that students find the LMS dull and uninspiring. This lack of stimulation can decrease student engagement and motivation, which is essential

for effective learning. Novelty, which assesses the innovativeness and creativity of the system, scored even lower, suggesting that the LMS lacks new and engaging features. This deficiency can result in a monotonous UX, diminishing student interest and engagement.

However, the benchmarking results highlight a critical issue: despite these positive mean scores, the LMS falls below average compared to similar systems. This discrepancy suggests that while the LMS meets the minimum acceptable standards for UX, it does not excel or provide a superior experience compared to broader industry benchmarks, indicating room for substantial improvement. The below-average scores in attractiveness, perspicuity, efficiency, dependability, and stimulation suggest that users find the LMS lacking in several key areas. Attractiveness, which measures the overall appeal of the system, is low, which indicates that students are generally dissatisfied with the LMS interface. This dissatisfaction can lead to reduced engagement and motivation, negatively impacting learning. Perspicuity, which assesses the ease of understanding and using the system, also scored poorly. Students may find the LMS confusing and challenging to navigate, hindering their ability to use the platform effectively for learning purposes. An inefficient LMS can lead to frustration and increased cognitive load, diverting students' attention from learning content to dealing with technical issues.

Efficiency, another critical scale, refers to the ability of users to complete tasks quickly and without unnecessary effort. The low score in this area suggests that students face obstacles preventing them from using their time effectively within the LMS. This can decrease productivity and learning efficiency, which are crucial for successful educational outcomes. Dependability, which reflects the reliability and consistency of the system, also falls below average. This indicates that students may perceive the LMS as unreliable, potentially leading to issues with trust and dependence on the platform for their educational needs. Frequent technical problems or inconsistencies can further exacerbate this issue, causing additional stress and dissatisfaction.

Stimulation, which measures the extent to which the system is exciting and motivating, also scored poorly. A lack of stimulation can lead to a disengaged and uninterested student body, which is detrimental to the learning process. An engaging and stimulating LMS maintains student interest and fosters a positive learning environment. Notably, the novelty scale, which assesses the innovativeness and creativity of the system, also received a "bad" score. Students do not find the LMS innovative or creative, suggesting that the system lacks new and engaging features that could differentiate it from traditional or outdated learning platforms. This deficiency potentially creates a monotonous and uninspiring UX, diminishing student engagement and satisfaction.

The implications of these findings are multifaceted. For LMS developers, it is imperative to address the identified weaknesses by improving the system's usability, reliability, and overall appeal. Enhancing the attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty of the LMS can lead to a more positive UX, thereby increasing student satisfaction and engagement. For students, the current state of the LMS may result in suboptimal learning experiences, potentially affecting their academic performance and overall educational outcomes. Educational institutions must prioritize UX in selecting and implementing LMS platforms to ensure that they support, rather than hinder, the learning process. Given the context of a private university in southwest Nigeria, it is essential to consider factors such as access to reliable internet, availability of digital devices, and students' prior experience with technology, which can all influence their perceptions and interactions

with the LMS. Addressing these contextual challenges can create a more supportive and effective e-learning environment.

Stakeholders, including educators and administrators, must recognize the importance of a high-quality LMS in facilitating effective teaching and learning. Investing in developing and improving LMS platforms can yield significant benefits, including enhanced student performance, increased engagement, and improved overall educational experiences. The results of this study underscore the need for comprehensive improvements in the LMS to enhance UX. LMS have quickly become a widely acceptable way to gain knowledge, and it is imperative to understand how users interact with these systems to learn and assess usability and factors that affect usability when using such products. Users have a good impression of a learning application and would mainly like to return to using learning applications if the LMS meets their needs; the LMS is easy to use and understand; their needs are met quickly by the LMS, and they feel secure when using the learning management system.

5 CONCLUSION

The findings of this study provide important insights into the UX of the LMS employed at a private university in southwest Nigeria, evaluated through the UEQ. While the LMS demonstrated generally positive mean scores across most UX dimensions, including attractiveness, perspicuity, efficiency, and dependability, significant concerns were highlighted in stimulation and novelty. The benchmarking results further underscored the need for improvement, as all scales fell below average compared to broader industry standards, with the novelty scale particularly standing out for its poor performance.

These results indicate that while the LMS is functional and satisfactory in basic usability, it lacks the engaging and innovative features necessary to support and enhance the learning experience fully. The low scores in stimulation and novelty suggest that the system is not sufficiently motivating or creative, potentially leading to decreased student engagement and satisfaction. For developers, this study emphasizes the critical need to address these deficiencies by incorporating more stimulating and innovative elements into the LMS. Enhancing these aspects can transform the LMS from a merely functional tool into a more dynamic and engaging learning platform. For educational institutions, prioritizing these improvements is essential to ensure that the LMS supports optimal learning outcomes and maintains high student engagement and motivation levels. In the context of the specific demographic and regional challenges the university faces, it is also crucial to consider factors such as access to reliable internet and technological infrastructure. Addressing these broader issues can further enhance the effectiveness and UX of the learning management system.

In conclusion, this study highlights the urgent need for a comprehensive overhaul of the LMS to enhance its UX. A thorough training program on the efficient use of LMS by staff and students should be developed by university administration, given the significance of cognitive aspects in the usage of LMS in Nigerian universities. The impact of this on utilization levels is multiplied. By addressing the identified deficiencies and incorporating more innovative and engaging features, stakeholders can work towards creating a more effective, efficient, and stimulating e-learning environment. Continuous assessment and improvement are necessary to adapt to the evolving needs of students and educators, ensuring that the LMS remains a valuable tool in the educational landscape.

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