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Learning Analytics Usability Factors towards Learner Performance Assessment – A Review of Literature

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Abstract- The Covid-19 pandemic significantly accelerated the adoption of e-learning, resulting in increased investment in digital education platforms and the generation of vast amounts of learner data, commonly referred to as big data. This shift has propelled the development of learning analytics, a field focused on the systematic collection, analysis, and reporting of data to better understand learner behavior and enhance educational outcomes. Despite growing interest in learning analytics, there remains limited understanding of its usability, particularly in assessing student performance within virtual learning environments. This paper presents a critical literature review examining the usability factors of learning analytics in the context of Kenyan universities. Using a desktop research approach, the study synthesizes existing research to identify key gaps and highlight usability dimensions relevant to performance assessment. The review identifies four primary factors influencing the usability of learning analytics tools: perceived usefulness, perceived ease of use, user satisfaction, and learnability. These findings provide a foundation for future empirical studies aimed at evaluating the impact of these factors on learner performance in virtual settings.

Keyword- learning analytics, learning analytics usability, perceived usefulness, perceived ease of use, user satisfaction, learnability..

I. INTRODUCTION

The COVID-19 pandemic significantly disrupted global education systems and triggered a global shift toward online education, leading to the rapid adoption and expansion of Learning Management Systems (LMS) like Moodle and Blackboard. [1], [2]. This caused a major rise in e-learning investment. In Kenya, the crisis catalysed increased investment in digital education platforms, by most universities such as the University of Nairobi and Kenyatta University. These developments occurred despite persistent challenges related to staffing, digital infrastructure, and system readiness [3], [4]. The rise of online learning platforms not only broadened educational access but also generated vast amounts of educational data, commonly referred to as "big data" [5]. This data includes valuable information such as students' backgrounds, learning trends, academic performance, and interaction patterns. When analysed through learning analytics, this information becomes a powerful tool for supporting student success.

Learning analytics (LA) refers to the systematic process of collecting, measuring, analysing, and reporting data about learners and their learning environments to understand behaviors and improve outcomes [6], [7], Whereas LA is the process of collecting and analysing, LA tools (LATs) are specialized software applications specifically designed to facilitate the above process within educational environments. These applications are instrumental in collection, analysis and reporting of educational data such as progress tracking, show grades, provide learning feedback, attendance monitoring, and evaluation of student engagement. Examples include visual dashboard systems and predictive analytics platforms that support decision-making and instructional interventions [8], [9].

Problem Statement

Despite increased awareness of LA, there is limited understanding on its usability. The effective deployment of LA depends heavily on its usability. If LA systems are difficult to navigate or interpret, their adoption and effectiveness are likely to be limited [10], [11].

Usability issues may discourage learners from engaging with these systems, particularly in institutions that are new to digital education methods. Research suggests that user-friendly design, coupled with proper training and institutional support, is crucial in encouraging uptake and long-term use of LA systems [12], [13].

Many learners encountered difficulty in effectively using LA, which in turn limited their engagement with the learning process [11]. Study showed some institutions that implemented LA without addressing learner usability had low uptake and continued reliance on traditional teaching methods [14]. When faculty perceive LA systems as cumbersome or irrelevant, they are less likely to integrate them into their teaching [12], [13].

Therefore, addressing usability is essential to fostering broader engagement with personalized and data-informed teaching methods [15]

Study Objectives

The study's objective was therefore: To establish LA usability factors towards learner performance assessment in virtual learning environment.

II. METHODOLOGY

The paper adopted desktop research which focused on review of current literature on learning analytics and learning analytics usability factors. The literature was collected based on their relevance using keywords- learning analytics usability factors, learning analytics in virtual learning environment in universities. The literature collection was further narrowed to only those are most recent, within 5 years of publication and ignored older publications. At the end of the study, the paper aimed to identify learning analytics usability factors that are linked toward student performance assessment.

III. DISCUSSION OF FINDINGS

Usability is a key concern in the implementation of LA in educational institutions. Usability is defined as the extent to which users can learn, use, and derive satisfaction from a system [16]. High usability is characterized by intuitive interfaces, logical navigation, and accessible features. Moreover, system quality, information quality, and service quality all contribute to a user's experience and likelihood of continued use [17].

Learning Analytics (LA)

Whereas, learning analytics (LA) is the measurement, collection analysis and reporting data from digital learning environments to improve teaching and student success, learning analytics tools (LATs) are specialized software applications such as LA dashboards, recommender systems, and platforms like SNAPP and Moodle Watchdog which help lecturers monitor student performance, offer personalized feedback, and make data-driven decisions. These tools rely on seamless integration with systems such as Learning Management Systems (LMS) to transform raw educational data into actionable insights that support real-time teaching interventions and learner engagement [8], [9], [20].

LA provides instructors with information on student behavior, academic engagement, and the strategies to improve their academic performance [21], [22], [23]. Implementing LA in e-learning environments can result in personalized interventions tailored to individual student needs, enhancing their motivation to learn, engage academically, and remain in class [21].

Though learning analytics (LA) holds great potential for improving educational outcomes its adoption in universities remains limited. Few studies have examined LA systems qualitatively, whilst most focus on learning design, student engagement, and performance.

Usability in Learning Analytics Systems

Usability refers to the simplicity and ease with which users interact with a system, enabling them to complete tasks effectively, efficiently, and satisfactorily [30]. According to ISO 9241-11, usability involves effectiveness, efficiency and user satisfaction. The ISO 9126 model outlines key characteristics that enhance usability: learnability, operability, attractiveness, and compliance with usability standards, all contributing to a functional and user-friendly experience [18]

Further refinements are found in the ISO/IEC 25000 framework, which adds recognisability, error protection, aesthetics, and accessibility—supporting inclusive design in e-learning environments [31]. Usable systems promote student engagement and academic performance [14]. Features such as learnability and satisfaction help improve learner experience and reduce dropout rates [25].

Learning Analytics Usability (LAU) Factors:

In the context of e-learning analytic systems, usability refers to the extent to which users can interact effectively and efficiently with the analytic system. Usability is defined as the degree to which a system can be used easily, efficiently, and satisfactorily by specific users to achieve specific goals [24]. The components of usability are as identified below:

Perceived Usefulness (PU):

Perceived usefulness (PU) is a central factor influencing system usability and plays a significant role in determining whether users will accept and continue to use an e-learning platform. It refers to the extent to which individuals believe that using a particular system will enhance their academic performance or learning outcomes. A notion that has been consistently validated across educational technology studies.

When learners perceive that a system contributes positively to their studies, they are more inclined to adopt and engage with it over time. [25]. These findings align with the Technology Acceptance Model (TAM), which suggests that the perceived benefits of using a system, particularly its contribution to performance, significantly shape users' willingness to adopt it. However, while TAM provides a parsimonious model, its limitations in accounting for contextual and social factors have led to the development of extended models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) [26].

The relationship between perceived usefulness and users' intention to use e-learning analytics system is further emphasized through describing the concept in terms of performance expectancy. This emphasises the students' belief in a system's potential to support their academic goals as the strongest predictor of whether they will use it or not [26], [27]. This study highlights that system characteristics such as high-quality information, interactive functionalities, and user-friendly features enhance students' perceptions of a platform's usefulness. [28] These findings align with the broader consensus that perceived usefulness is not only a predictor of initial adoption but also of long-term user engagement.

Perceived Usefulness (PU) is a determining factor in whether users adopt and continue using a system, particularly within frameworks like the Unified Theory of Acceptance and Use of Technology (UTAUT). Factors such as well-structured content, instructional design, and system interactivity play a critical role in helping users achieve their objectives efficiently, thereby enhancing their perception of the system's practical value [29]

Additionally, users are more likely to accept and persist in using a system when they perceive it to offer clear, tangible benefits such as improved decision-making and enhanced productivity [30]. This suggests that the user's experience of practical gains, rather than abstract functionality, is what ultimately shapes perceptions of usefulness. Similarly, a system's consistent ability to perform effectively and meet user expectations leads to a stronger belief in its usefulness [31]. This means that when users believe that a system genuinely supports their learning and academic performance, through reliable information, intuitive features, and measurable benefits, they are more likely to accept, use, and remain engaged with it.

Perceived usefulness is one of the determinants of usability, reflecting users' belief that a system improves task performance and learning outcomes. It is integrated into the USE instrument [34], which captures users' evaluations of a system's practical value. The instrument includes four core dimensions: usefulness, ease of use, ease of learning, and satisfaction, forming a user-centered evaluation framework supported by consistently high reliability and validity measures [32]. Its application in educational contexts corresponds with studies by [33], [19], and others, affirming perceived usefulness as an essential component of usability.

Perceived Ease of Use (PEoU)

Perceived ease of use (PEoU) is a critical construct in the assessing the effectiveness of e-learning systems, as it is often linked to users' initial acceptance and continued engagement. It is generally defined as the extent to which users believe that using a particular system will require little effort. The platforms are designed with simple interfaces, clear navigation, and low complexity hence reducing users' cognitive load. [25] This reduction in cognitive load contributes positively to the overall usability of the system, as users can focus more on learning tasks rather than on figuring out how to operate the platform.

The concept closely aligns with the concept of "effort expectancy," particularly within technology adoption models such as UTAUT [28]. This highlights that system learnability, the clarity of instructions, and the simplicity of navigating through content all have a significant influence on users' behavioural intentions. [28] In other words, systems perceived as easy to use are more likely to be accepted and integrated into regular academic practices.

The importance of clear visual design and engaging features, suggest that such design elements minimize the cognitive strain associated with navigating complex systems. [29] The presence of these characteristics not only supports task efficiency but also enhances the user's perception of the system's overall utility, making it more likely to be adopted and used consistently. This means that when a system is perceived as free from unnecessary effort, users can concentrate on their primary tasks rather than on learning how to use the system, which in turn indirectly strengthens its perceived usefulness [30].

Additionally, tangible system characteristics; such as operational consistency and self-explanatory interfaces are identified as key facilitators of user interaction [31]. These features help users navigate the system without requiring extensive technical training, making the platform more accessible to individuals with varying levels of digital proficiency [31]

When users encounter few barriers in using a system, their confidence in the platform increases, which in turn promotes user acceptance and continued engagement [26]. This assertion is supported through empirical study demonstrating an easy-to-use system not only boosts user confidence and reduces the learning curve but also contributes significantly to system adoption, especially in environments with varying levels of digital literacy [27]

Perceived ease of use therefore shapes how users interact with digital learning environments, affecting their confidence, satisfaction, and willingness to adopt the system. Well-designed platforms that prioritize intuitive operation, visual clarity, and consistency in functionality can significantly enhance the user experience, making them essential for successful implementation in educational settings.

User Satisfaction

User satisfaction is consistently identified in the literature as a fundamental outcome of system usability, particularly within e-learning environments. It reflects the user's affective response to the degree to which a system meets their expectations and supports their learning objectives. User satisfaction is closely tied to the effectiveness of instructional design and the overall performance of the system [25]. This suggests that when users

are satisfied with how the system supports their learning processes, this translates into higher levels of perceived usability and increased system acceptance.

Although satisfaction may not always be directly addressed in adoption models, its influence is embedded in constructs such as behavioural intention. Factors like the provision of high-quality information and interactive features significantly shape users' positive perceptions, indirectly enhancing both satisfaction and perceived usefulness [28]. This positions satisfaction as both an outcome and a reinforcing factor in the continuous use of e-learning systems.

Features such as visual appeal, straightforward navigation, and timely feedback mechanisms are integral components that improve the overall user experience and contribute to satisfaction [29]. These elements reduce frustration, increase confidence, and foster a sense of control, which are key indicators of satisfaction in digital learning environments. Moreover, user satisfaction can be measured through standardized tools such as the System Usability Scale (SUS) and the Computer System Usability Questionnaire (CUSQ), offering empirical means to assess and benchmark user experiences.

From a user-centred perspective, satisfaction is an emotional response that arises when a system consistently meets user expectations [30]. Such satisfaction fosters trust, promotes repeated use, and can lead to advocacy for the system among peers. This emphasis on emotional engagement underscores the role of user satisfaction in sustaining long-term system adoption.

Additionally, satisfaction emerges not only from the successful delivery of functional features but also from the emotional resonance of design aesthetics [31]. This suggests that intuitive and visually pleasing interfaces contribute to a more satisfying user experience, particularly when users perceive the system as both practical and engaging.

Perceived system effectiveness in meeting academic and personal needs enhances satisfaction, which in turn supports continued use and fosters positive recommendations [26]. This reinforces the cyclical nature of satisfaction, where positive user experiences lead to repeated use, which in turn builds deeper engagement and trust.

Therefore, user satisfaction can be integrated within a broader success framework, indicating that the quality of information, system performance, and user support services are all critical determinants of satisfaction [27]. These findings demonstrate that satisfaction not only reflects immediate user experiences but also strengthens the perceived overall value and usability of the system.

Learnability

Learnability is a key dimension of e-learning system usability, referring to how quickly and easily users can become proficient in using a platform. It directly influences user adoption, satisfaction, and long-term engagement, particularly in settings where users vary widely in their digital literacy. Additionally, learners view the system more favourably when they can efficiently access course materials, follow well-structured instructions, and complete learning tasks with ease [25]. These initial interactions shape the learner's perception of usability and establish a foundation for continued use.

Although often considered a subset of perceived ease of use, learnability has a distinct function within usability models. The students' ability to quickly understand and navigate learning management systems (LMS) significantly enhances their perception of usability [28]. While learnability has a stronger influence on perceived ease of use than on perceived usefulness or behavioural intention, its impact is nonetheless essential for fostering a user-friendly environment, especially for novice users [28].

Learnability is defined as the speed and ease with which users master a system, noting that high learnability minimizes the need for extensive training and support [29]. Systems with high learnability reduce users' dependence on external guidance and technical help, thereby improving efficiency and reducing barriers to participation. This is particularly relevant for institutions aiming to scale e-learning quickly without overwhelming support infrastructure.

E-learning platforms requiring minimal on-boarding time are more effective in diverse user populations as they reduce demand for training [30]. In such contexts, ease of initial learning not only enhances individual user experiences but also ensures broader institutional success in deploying e-learning tools at scale. This argument reflects a growing consensus that learnability is not only about user adaptation but also about the system's adaptability to user needs.

Additionally, clear interface design and well-developed instructional content play a pivotal role in minimizing the learning curve [31]. Users benefit from interfaces that are intuitive and supported by comprehensive documentation, as these elements reduce confusion and increase user independence. The presence of these design features is particularly important during critical transitions, such as the shift to remote learning, where time for formal training is often limited.

Similarly, learnability is linked to increased user satisfaction and engagement, noting that users are more likely to embrace systems they can quickly become comfortable with [26]. This sense of early competence builds confidence, which in turn promotes ongoing use and deeper engagement with the system's features.

While learnability is frequently integrated into broader constructs like ease of use, it plays a distinct and strategic role in encouraging rapid system uptake [27]. This means that, in dynamic learning environments, particularly during abrupt transitions like those prompted by the COVID-19 pandemic, systems with intuitive design and low complexity are more likely to succeed in supporting users with varying degrees of technological familiarity.

Many studies concur that learnability is a foundational element in the design and evaluation of e-learning systems [26], [27]. Its influence extends beyond simple user adaptation to affect engagement, satisfaction, and institutional scalability. A focus on intuitive design, minimal training requirements, and accessible instructional support is essential for maximizing the effectiveness and reach of digital learning systems.

IV. CONCLUSION

From the literature review, the four learning analytics usability factors identified are: Perceived Usefulness, Perceived Ease of Use, User Satisfaction and Learnability.

Future study can replicate this and conduct an empirical analysis of this to identify the usability factors that influence performance assessment of university students in virtual learning environment.

Further study can also be done to test this against causal relationship with learner performance metrics and determine whether learning analytics usability has significant influence on learner performance in virtual learning environment.

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