Educators' Perspectives on Usability of the Moodle LMS: A Case of the National Institute of Transport, Tanzania

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Abstract: The purpose of this study was to assess the usability of the Moodle LMS at the National Institute of Transport in Tanzania. The study employed a descriptive research design that involved the use of a questionnaires and interview to collect data from 35 educators who were using the Moodle LMS. Quantitative data was analyzed using the SPSS while qualitative data involved content analysis. The study identified effectiveness, satisfaction, memorability, learnability and errors factors to be used to assess usability issues. The study revealed that educators encountered usability problems related to navigation, content, layout, interaction, feedback, help and support. The study recommends that the NIT should focus on providing a user-friendly interface, clear content, consistent layout, enhanced interaction and timely feedback to improve the usability of the Moodle LMS. By addressing these usability problems, NIT will enhance the effectiveness of teaching and learning activities. Moreover, the study recommends regular training to teachers on how to use the Moodle LMS.

Keywords: Attributes; Usability; Moodle LMS; Instructors; usability evaluation.

Introduction

The use of Learning Management Systems (LMS) has become a popular trend in learning institutions worldwide, including Tanzania due to initiatives directed towards ICT integration in academia (Mtebe & Raphael 2018). LMS is a software application used to manage, document, track and deliver educational materials. It has become a vital tool in the delivery of online education and it provides a platform for creating, managing and delivering educational content to students and furthermore it can also be used for assessment and reporting of the same. It has made educational material available even over long distances, hence supporting open and distance learning. Learning institutions can acquire LMSs through procurement of existing systems or development their own systems (Mthethwa & Maphosa, 2020).

Currently there exists installable LMSs such as Chamilo E-learning and Collaboration Software, Modular Object-Oriented Dynamic Learning Environment (Moodle), Google Classroom, Edmodo, Schoology and Blackboard Learn. Studies have compared these LMS and Moodle LMS seems to be a favorable choice for many institutions because it can be installed in any environment and it has many functionalities. Furthermore, it can be used without Internet connectivity. It is open source as it can be customized according to an institutions' particular requirements (Alghafis, et. al. 2020; Alva, et. al. 2021; Thuseethan et. al. 2015 and Karadimas, 2018).

In Tanzania, several universities, colleges and schools have adopted the Moodle LMS as part of their e-learning initiatives. University of Dar es Salaam, Open University of Tanzania and Mzumbe University are among the Higher Learning Institutions that have adopted the use of the Moodle LMS in Tanzania for blended and distance education (Mtebe & Raphael 2018). The implementation of the Moodle LMS in institutions usually involves several steps, including installation, configuration, customization and training. Institutions may choose to install Moodle on their own servers or use cloud-based hosting services provided by Moodle partners. Once installed, Moodle can be customized to reflect the institution's branding, policies and requirements. Training and support are essential components of Moodle implementation to ensure that educators and learners can effectively use the platform.

The National Institute of Transport (NIT) is an HLI that has also adopted the Moodle LMS. Student enrolment in the Institute has increased in the past three years. In academic year 2019/20, the Institute enrolled 3,591 new students, 5,267 students in 2020/21 and 5,631 students in 2021/22. The enrollment for the 2022/23 academic year is expected to be higher than the previous year. These statistics indicate that there are many potential students who need NIT's education services within and outside Dar es Salaam. It can also imply that there are some who fail to join the Institute due to distance from their homes to the Institute.

Luckily, Information Technology is currently playing a major part in the delivery of content to students as supported by Thuseethan et al. (2015). Furthermore, LMS is one of the software that assists in teaching and learning and there are several benefits that are associated with it. Moreover, the recent COVID-19 global pandemic has necessitated the need to have an alternative means of delivery where physical contact is absent. It was during this time that the importance of e-Learning platforms was epitomized. For these reasons, the Institute decided to adopt the Moodle LMS. The NIT Management in collaboration with the World Bank's EASTRIP project via the Center of Excellence in Aviation and Transport Operations (CoEATO) launched the software for the Institute in January 2021. A situational analysis was conducted and the system was installed on the Institute Infrastructure. Training was thereafter conducted for the teaching staff to familiarize with the system so as it can be effectively used. The LMS will give the NIT an alternative method of learning and education service delivery that can accommodate and reach a large number of students, make access to materials easier and ensure continuity of teaching and learning regardless of varying situations.

Moodle LMS is a widely used platform for delivering online learning materials, facilitating student-teacher interactions and managing assessments. However, the effectiveness of the Moodle LMS depends on its usability, which refers to how easy it is for users to learn and use the system. Usability is

a critical factor in the success of any technology, including the Moodle LMS (Senol, et. al. 2014). It is also one of the main criteria mostly considered by LMS developers (Alghafis et. al. 2020). A system with poor usability can hinder learning and create frustration for users while a system with good usability can enhance learning outcomes and satisfaction. Since the learning of students in the LMS depends on the contents from educators, further work is needed to identify usability problems from the educators' perspective in order to ensure good usage of the system by the lecturers and thus good performance of the students (Oguguo et at. 2021). Therefore, assessing the usability of the Moodle LMS from the lecturers' perspective will provide insights into challenges they face while using the system and how the system can be improved to meet their needs. Not only that but also it will help to recommend improvements that can enhance the quality of education for students and improve the effectiveness of teaching and learning activities. Despite many studies that assessed the usability of LMS platforms in other contexts such as from students' perspective (Mtebe & Raphael 2018), there may be limited research that specifically addressed experiences and challenges faced by educators who use Moodle. Therefore, there is a need for a study that explores how educators at NIT perceive the usability of Moodle, the extent to which they find it user-friendly and identify issues or challenges they face when using the platform. Additionally, the study could explore potential strategies for improving the usability of Moodle at NIT to enhance its effectiveness as a teaching tool.

This study focused on identifying usability problems associated with the Moodle LMS in HLIs in Tanzania using the instance of the NIT from instructor's perspective and providing recommendations to improve the platform's usability.

Literature Review

Usability is defined as the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use (Bevan et al., 2015). The usability of a product is a critical factor in determining its success, as it directly affects users' satisfaction and productivity (Nielsen, 1993). Moodle LMS usability is important because it determines the extent to which teachers can effectively and efficiently use the platform to deliver content, engage with students and provide feedback. During the learning process, both teachers and students needs to learn how to use the platform. If the platform does not provide a good usability, the users will spend more time trying to understand how to use it rather than learning or using its contents (Abuhlfaia & de Quincey, 2018; Nakamura, et. al. 2017). The Moodle LMS interfaces are required to focus on user's requirements by providing a clear idea on content arrangement, navigation and system functionalities. The user should be engaged in using the process without being overwhelmed (Ardito, et al. 2004). If the usability of the Moodle LMS is bad, users will fail in their attempt to use the platform, hence left feeling frustrated, unsatisfied and thus lead to ineffective use (Kiget et al. 2014; Abuhlfaia & de Quincey, 2018. Senol and Gecili (2014) seemingly agreed with previous authors that usability is essential for a software system to show the capability of that system to be used easily, effectively and satisfactorily. Other studies have highlighted the importance of specific usability metrics in assessing the usability of the Moodle LMS. For example, Abhirami and Devi (2022) identified efficiency, learnability and satisfaction as the most important usability metrics for the Moodle LMS. Similarly, a study by Alghabban and Hendley (2022) identified efficiency, effectiveness and satisfaction as the most important usability metrics for the Moodle LMS.

Previous studies recommended various strategies for improving the Moodle LMS usability. For example, a study by Alghabban and Hendley (2022). recommended implementing an adaptive design that is customizable, based on user needs and preferences. Additionally, Amhag et al. (2019) recommended providing training and support for teachers to enhance their skills in using the Moodle LMS effectively. While all these studies showed the general usability of Moodle is good, there were still issues highlighted in satisfaction and learnability of the Moodle LMS. Studies have identified various usability issues with the Moodle LMS that can affect its effectiveness and efficiency in the education sector. For example, a study by Hasan (2018) found that usability issues with the Moodle LMS included difficulties with navigation, content organization and lack of feedback mechanisms. Furthermore, the author determined usability by comparing the features found in the Moodle LMS over those needed by users and in this aspect found that there are features such as online meetings that were absent. Moreover, poor usability led to difficulties in

users performing registration and submission of assignments.

In order to mitigate these challenges, most authors performed usability evaluations to identify which aspect of usability had shortfalls. Evaluation is an important exercise as it allows the users to interact with the system and participate in bettering it, thus feeling as part of the process and hence having a more positive attitude towards using the system. Literature shows a vast number of methods that can be used to evaluate usability. There are analytical methods of evaluation, which are more used by experts to determine if the system is usable or not. Methods such as Heuristic Evaluation, Cognitive Walkthrough and Thinking Aloud have been mentioned by Plantak et. al. (2010). These same three methods have been stated by other authors such as Senol et al. (2014) but they have been categorized as testing, inspection and inquiry-based methods. In the study of Senol et al. (2014), Heuristic Evaluation is considered as inspection based while Cognitive Walkthrough and Thinking Aloud are considered as testing based and inquiry based are methods such as questionnaire.

Usability evaluation is based on attributes, which tend to differ from one literature to another due to evolution of interface design technologies and interaction styles (Bruno & Al-Qaimari, 2004). Several authors have identified various usability attributes, based on the context of use. Weichbroth (2018) revisited usability attributes from various standards and models from 1991 to 2018 and analyzed which attributes have most been used in the literature. The final list of attributes identified by ISO covering usability in HCI were similar to those identified by Nielsen (1993). Nielsen (1993) and Shneiderman (1998) highlighted a multidimensional feature of usability attributes where in order for a system to be usable, it must consider learnability, efficiency, memorability, error tolerance and satisfaction. These metrics for usability evaluation are similar to those identified by Eltahir et al., (2019) and suggested by Shackel and Richardson (1991). These metrics are commonly used to evaluate the usability of software applications, including Learning Management Systems such as Moodle LMS. Learnability refers to the ease with which users can learn to use the system. Efficiency refers to how quickly users can accomplish tasks using the system. Memorability refers to how easily users can remember how to use the system after a period without using it. Errors refer to the number of

mistakes users make while using the system. Lastly, satisfaction refers to the level of user satisfaction with the system. During the development process of a system, usability attributes have an impact on the process since they are considered as usability requirements and can be quantified and measured when evaluating the usability of the system (Bruno & Al-Qaimari, 2004).

Various studies have been done on the issue of usability in the Moodle LMS for improvement (Abuhlfaia & de Quincey, 2019; Amandi & Shanika, 2021; Pangestu & Karsen, 2016 and Fahad et al. 2015). Amandi and Shanika (2021) determined factors that affect usability on the Moodle LMS and found that good usability can enhance students' performance. Pangestu and Karsen (2016) evaluated the usability of the Moodle LMS at HEIs using criteria such as usefulness, satisfaction, ease of learning and ease of use. The study concluded that the platform still needs some improvement, specifically on satisfaction and ease of use to provide better usability. Whereas Abuhlfaia and de Quincey (2019). Hassan (2019) and Melton (2006). found usability issues such as intuitive design, navigation and missing features led to poor students' performance on the system. Melton (2006). commended the Moodle LMS for being created to meet usability issues; however, some issues such as indications of visited links were not considered causing users to re-click the same links several times.

Most of reviewed studies on evaluating usability issues in LMS (such as Abuhlfaia & de Quincey, 2019). Amandi & Shanika, 2021; Emang et al. 2017) concentrated on students' perspectives. Other studies were rather general to all users (Shahid & Abbasi, 2014). Not only that most of the studies did not provide feedback with suggestions to rectify the identified usability problems, but also most problems identified were not directly linked to the usability attributes, hence the results were more general. Annamalai et al. (2021) found that students' engagement in LMSs can be facilitated by educators when using the LMSs to promote learning independence, such as completing tasks and assignments without educators' influence. However, it is still difficult for educators to find useful information and use LMSs effectively (Abuhlfaia & de Quincey, 2019; Annamalai, et al. 2021). Since learning in LMSs depends on the contents from educators, further work is needed to identify usability problems from the educators' perspectives

in order to ensure good usage of the system by the educators and thus good performance of the students. Hence, this study aimed to assess the usability of the Moodle LMS at the National Institute of Transport in Tanzania from the perspective of teachers to identify strategies for improving its usability through identifying attributes that can be used to assess usability problems, to identify the usability problems found from the attributes and to recommend improvements for the Moodle LMS.

Methodology

Design

This study employed a descriptive research design, a methodology that focuses on objectively observing existing phenomena without manipulating variables. In the context of investigating educators' perspectives on the usability of the Moodle LMS, this design was chosen to provide a comprehensive representation of their experiences and opinions. By utilizing questionnaires and interviews, this approach enabled a detailed exploration of how educators interacted with Moodle, shedding light on its strengths and limitations from their viewpoint

Population and Sampling

The study's population involved 35 educators who were given initial training to use the Moodle LMS at the National Institute of Transport. The 35 respondents were an adequate sample size since there are around 300 instructors as it was suggested by Israel (1992) that a good sample size could be 10% to 30% of the entire population. The targeted respondents were educators from all the teaching departments of NIT that could provide vivid information and feedback on the Moodle usage.

Instruments

The quantitative data was collected using a questionnaire while qualitative data was collected using interview and documents. The questionnaire consisted of open-ended items and Likert scale items that were used to gather data on educators' opinions on the usability of the Moodle LMS. The interview items were open-ended and they focused on identifying challenges experienced by educators while using the Moodle LMS and proposing possible solutions. The questionnaire was designed based on known principles of usability, such as from Nielsen's usability principles and standard known usability testing tools such as System Usability Scale (SUS) (Brooke,1995), the Website Analysis Measurement Inventory (WAMMI) and Zaharias and

Poylymenakou (2009) which have been used as the main instrument for the five-point Likert scale where the latter was found to measure usability in E-Learning with pedagogical elements and students' motivation to learn in it (Sandoval, 2005).

Validity and Reliability

Data validity was measured in terms of pilot testing where 10 respondents who were not included in the study sampling participated in responding to the questionnaire. Data reliability was measured with Cronbach's alpha as suggested by Matkar (2012) which was between $0.8 \leq \alpha < 0.9$ and it was referred to as good reliability.

Statistical Treatment of Data

Data collected from both the questionnaires and interviews was analyzed using descriptive statistics and content analysis. Descriptive statistics through the SPSS analyzed the quantitative data from the questionnaires while content analysis analyzed the qualitative data from the interview. Sample mean value for every attribute on the five-Point Scale (strongly agree = 5, agree= 4, neutral = 3, disagree = 2 and strongly disagree = 1) was calculated since the summed scale is more reliable than single-item scales (Joshi, et. al. 2015).

Ethical Considerations

Consideration of ethical issues was important for ensuring the privacy and consent of the participants. Before responding to the questionnaire, the subjects were required to read and fill the informed consent. The information was treated confidentially and anonymously to avoid ethical issues.

Results and Discussions

This section presents results of the study. It starts with demographics factors of respondents and then moves into the analysis of research questions. .

Demographics of Respondents

There were 35 educators who participated in the study as seen in Table 1 whereby 25 (71.4%) were males while 10 (28.6%) were females. The most frequent education level of respondents was master's degree with 22 (62.9%) respondents, followed by seven (20%) with doctorate degrees and six (17.1%) with bachelor's degrees. Respondents were from six departments with their teaching experience ranging from lesser than 1 year to more than 10 years. These results signify that the sample covered a variety of educators from different demographic backgrounds.

Table 1: Demographics of Respondents

Factor	Category	f	%
Gender	Female	10	28.6%
	Male	25	71.4%
	Total	**35**	**100%**
Education	Undergraduate	6	17.1%
	Masters	22	62.9%
	Doctorate	7	20.0%
	Total	**35**	**100%**
Working experience	Less than a year	1	2.9%
	1-5	8	22.9%
	6-10	16	45.7%
	More than 10	10	28.6%
	Total	**35**	**100%**
Department	CCT	13	37.1%
	BES	7	20.0%
	LTS	4	11.4%
	TET	5	14.3%
	AVIATION	4	11.4%
	MHSS	2	5.7%
	Total	**35**	**100%**

Analysis of Research Questions

The findings of this study were guided by three research questions as follows:

Research Question 1: What are attributes that can be used to assess usability?

Data for this research question was from literature. The analysis of literature revealed that Effectiveness, Learnability, Memorability, Satisfaction and Errors are essential attributes for assessing the usability of the Moodle LMS. Effectiveness is the ability of the system to complete the user's task. Learnability refers to how easy it is for users to learn how to use the Moodle LMS. It includes factors such as the availability of training materials, ease of understanding the system and simplicity of the interface. Memorability refers to how easy it is for users to remember how to use the Moodle LMS after a period of not using the system. It includes factors such as consistency in the layout, labeling of buttons and availability of help materials. Errors refers to the frequency and severity of mistakes encountered by users when using the Moodle LMS. It includes factors such as the clarity of error messages, availability of error recovery mechanisms and prevention of errors. Satisfaction refers to how to contend users. It includes factors such as the ease of use, availability of features and relevance to the users' needs.

Effectiveness was pointed out by Talha et al. (2020) as an attribute for usability and has been used as such interchangeably with efficiency, which refers to the speed of completion. Effectiveness was further used by John Brooke who created the System Usability Scale (SUS) in 1986, which is a questionnaire for determining usability. SUS is the most common tool for usability testing in small sample sizes as derived by Binaymin et al. (2016). Thuseethan et al. (2015) reiterated that usability can be assessed using four criteria, including effectiveness and learnability. Senol and Gecili (2014) mention other usability attributes including Learnability, Memorability, Satisfaction and Errors. The others are flexibility, which consists of elements of learnability, memorability and attitude, which is satisfaction of the user for the system. Kumar et al. (2020) assessed usability based on satisfaction of undergraduate students in Ghana. Effectiveness, Memorability and Satisfaction have also been used by Kakasevski et al. (2008). to assess usability, showing that these attributes stand the test of time. A systematic literature review conducted by Abuhlfaia and De Quincey (2018) revealed that effectiveness, learnability, satisfaction and memorability were the most used attributes to test for usability.

The attributes thus identified and which were used to evaluate the usability of the Moodle LMS on educators' perspective for this study were Effectiveness, Satisfaction, Memorability, Errors and Learnability.

Research Question 2: What are usability issues found in the selected attributes?

Findings for the first research question predetermined attributes upon which usability issues would be assessed (Effectiveness, Satisfaction, Memorability, Errors and Learnability). Although the questionnaire items were in five point Likert scale, the analysis grouped the responses into three categories: Disagree, Neutral and Agree. The analysis of the data revealed the following usability issues:

Effectiveness
As defined in the previous research question, effectiveness refers to the ability of the system to complete given actions. Educators responded to seven items in the questionnaire regarding effectiveness and responses appear in Table 2.

Table 2: Effectiveness (n = 35)

	Disagree		Neutral		Agree	
	f	%	f	%	f	%
SA1	23	65.7	7	20	5	14.3
SA2	32	91.4	3	8.6	0	0
SA3	2	5.7	8	22.9	25	71.5
SA4	3	8.6	9	25.7	23	65.7
SA5	0	0	0	0	35	100
SA6	24	68.6	4	11.4	7	20
SA7	1	2.9	7	20	27	77.1

Table 3: satisfaction (n=35)

Disagree		Neutral		Agree	
f	%	f	%	f	%
0	0	4	11.4	31	88.6
33	94.3	2	5.7	0	0
2	5.8	2	5.7	31	88.6
31	88.6	3	8.6	1	2.9
29	82.9	5	14.3	1	2.9
7	20	7	20	21	60
0	0	7	20	28	80
25	71.4	8	22.9	2	5.7

All respondents agreed that they can upload notes easily (SA5). More than half of the respondents (65.7%) disagreed that the system responds slowly (SA1), indicating that the respondents viewed the system reactions as fast. Similarly, almost all respondents disagreed that the system did not add to their productivity (SA2) and more than as half disagreed that the system takes too long to upload (SA6). Furthermore, more than three-quarters of respondents agreed that the system responded as was expected (SA7) and about three quarters agreed that it was easy to accomplish tasks quickly (SA3). Finally, more than a half of the educators agreed that assessment is more efficient in the system than when traditional methods are used (SA4). These results reveal that respondents considered the system as effective in administering required tasks. The findings correspond with the study of Alghafis et al. (2020) which concluded that the Moodle LMS is better than others due to its ability to upload and download different types of files faster. It also corresponds with the findings of Santoso and Efendy (2020) in which respondents were positive about the completion of functions and completeness of features using the Moodle LMS.

Satisfaction
As defined in the previous research question, satisfaction refers to how content users are with Moodle. Educators responded to eight items in the questionnaire regarding satisfaction with the Moodle LMS and responses appear in Table 3.

Most respondents agreed that they enjoyed working with the system (SB1=88.6%), the interface is attractive (SB7 =80%) and that they would recommend it to other people (SB3 = 88.6%). Regarding expectations, more than a half (60%) of respondents agreed that the system has all functions they expected (SB6). Majority of the educators were observed to disagree that using the system was a waste of time (SB2 = 94.3%) and that the system had boring features (SB4 = 88.6%). They also disagreed that it is difficult to tell if the system had what was wanted (SB8 = 71.4%) and that they

would not like to use the system frequently (SB5 = 82.9%). These results are synonymous to those by Santoso and Efendy (2020) and Saputra and Kusuma (2022) whereby most users who participated in the study liked using the system and were satisfied with the system.

Memorability

As defined in the previous research question, memorability refers to how easy it is for users to remember how to use the Moodle LMS after a period of not using the system. Educators responded to five items in the questionnaire regarding the memorability of the Moodle LMS and responses appear in Table 4.

Table 4: Memorability(N=35)

	Disagree		Neutral		Agree	
	f	%	f	%	f	%
SC1	3	8.6	8	22.9	24	68.5
SC2	24	68.6	5	14.3	6	17.1
SC3	6	17.1	5	14.3	24	68.5
SC4	29	82.9	5	14.3	1	2.9
SC5	6	17.1	4	11.4	25	71.5

Table 5: Errors (n=35)

	Disagree		Neutral		Agree	
	f	%	f	%	f	%
SD1	5	14.3	6	17.1	24	68.6
SD2	19	54.3	6	17.1	10	28.6
SD3	25	71.5	5	14.3	5	14.3
SD4	5	14.3	10	28.6	20	57.2
SD5	11	31.4	14	40	10	28.6
SD6	27	77.1	4	11.4	4	11.5

The interaction between educators and the system enabled the educators to respond to the five items regarding memorability. The respondents showed agreement with the following three statements: It is easy to memorize the steps when uploading teaching contents (SC1 =68.5%), I can quickly find what I want on the system for the second time I use the system (SC3 = 68.5%) and I find it easy to remember the icons after logging in back (SC5 = 71.5%). Respondents further disagreed with the following statements, which were negatively stated: remembering where I am on this system is difficult (SC2 = 68.6%) and It is difficult to repeat performing a task in this system (SC4 = 82.9%). These statements signify that remembering how to use the Moodle LMS was easy for the educators. This is consistent with findings made by Arora, et. al. (2022) where by memorability scored highly in the assessment of the usability.

Errors

As defined in the previous research question, errors is an attribute, which constitutes mistakes made and mechanisms to recover from such errors. Educators responded to six items in the questionnaire regarding errors in the Moodle LMS and responses appear in Table 5.

In this category majority of respondents disagreed that they spent too much time correcting errors on the system (SD3 = 71.5%) and that the system does not give clear instructions in case of errors (SD6 = 77.1%). Furthermore, most educators (68.6%) agreed that the system gives feedback on time in case of error (SD1). More than a half (57.2%) was observed in agreement that users recovered quickly when mistakes are made (SD4). There results were in agreement with results from Senol et al. (2014), where users stated that the system was logical enough for them to rollback and proceed in case of errors. However, more than a half the respondents (54.3%) agreed that they came across a lot of technical jargons (SD2) meaning that the system used technical language in some area which made it hard for them to understand. Similar feedback was given by a heuristics evaluation in the study of Ramos et al. (2021), whereby error messages were noted. However, they did not show the actual reason for the error.

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Learnability

As defined in the previous research question, learnability refers to how well and easy users can learn the features of the system. Educators responded to five items in the questionnaire regarding the memorability of the Moodle LMS and responses appear in Table 6.

Learnability comprised of seven statements, which were responded to as follows. The table shows that 45.7% disagreed that it takes time to familiarize oneself with the system (SE1), 40% agreed and 14.3% were neutral to the clause. Therefore, a bigger number of respondents disagreed with the statement. Furthermore, 37.1% of the educators disagreed that less effort is needed to learn and understand the system (SE2) while 45.7% agreed with the statement and 17.1% were neutral.

Table 6: Learnability (n=35)

	Disagree		Neutral		Agree	
	f	%	f	%	f	%
SE1	16	45.7	5	14.3	14	40
SE2	13	37.1	6	17.1	16	45.7
SE3	16	45.7	9	25.7	10	28.6
SE4	17	48.5	5	14.3	13	37.1
SE5	7	20	7	20	21	60
SE6	29	82.9	2	5.7	4	11.5
SE7	2	5.7	10	28.6	23	65.7

Table 7: Interpretation of the 5-Point Likert Scale and Mean Range

Interpretation	Weight	Mean range
Highly usable	5	4.51 – 5.00
Usable	4	3.51 – 4.50
Moderately usable	3	2.51 – 3.50
Slightly usable	2	1.51 – 2.50
Not usable	1	1.00 – 1.50

Different views were recorded on the issue of technical support. For instance, 28.6% of the respondents agreed that technical support was needed to use the system (SE3) while 45.7% disagreed meaning that they could easily learn and use the system on their own and 25.7% were neutral. Furthermore, 37.1% of the educators needed to learn a lot of things before using the system. This group found it difficult to learn the system (SE4). On the same statement 48.5% of the educators disagreed that a lot of things needed to be learned before using the system. This implies that the group generally found the system easy to learn. This is similar to findings of Santoso and Efendy (2020). where most users were neutral or disagreed with the fact that a lot was to be learned before the system would be useful. Most of the respondents agreed that it was easy to predict the next move (SA5) meaning the system is learnable. The same applies to buttons and links whereas most respondents disagreed that buttons and links were hard to understand (SA6). The last statement was regarding online help whereby majority of respondents agreed that there is sufficient online

assistance for the system (SA7). The findings indicate that the system was easy to learn for most users as was also observed by Senol et al. (2014; Saputra and Kusuma (2022).

Summary

The mean was calculated for all the attributes to determine the overall perception of the NIT educators on the usability of the Moodle LMS. The translation of the means can be seen in table 7. This translation had been used by other authors, such as Bringula and Bassa (2011) to summarize results. The table shows that mean ranging from 4.51 to 5.00 translates to highly usable, 3.51 to 4.50 translates to usable, 2.51 to 3.50 to moderately usable, 1.51 to 2.50 to slightly usable and lastly 1.00 to1.50 to not usable.

Results in figure 1 show that the most accepted attribute was satisfaction, which scored the mean of 4.2. This can also be seen in the study of Arora et. al. (2022) whereby the subjects responded positively to satisfaction towards the system. Other attributes such as effectiveness and memorability showed high means which reflects that the educators found the

system effective and that remembering was easy. Similar conclusions have been arrived at by Binaymin, et al. (2016) in whose results, the overall usability was good although there were still issues that needed improvement.
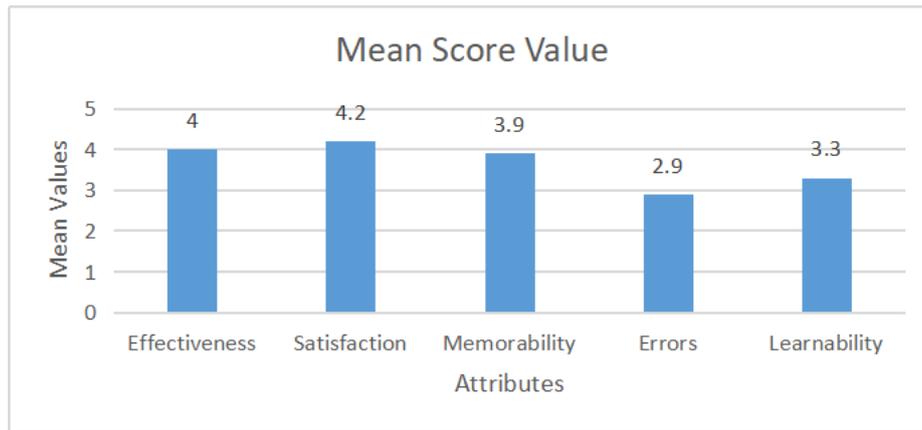

Figure1: Mean Score Value for Overall Usability per Attributes

Two attributes namely errors and learnability, however, showed moderate usability whereas errors scored 2.9 and learnability scored 3.3. These are in accordance to the findings in the survey statements, where there were a significant number of respondents who had problems with learnability and errors. Examples are the need of 37.1% of educators to learn a lot of things in order to use the system and the perception of 54.3% of the educators that the system had a lot of technical jargon, causing it easy to make errors while using the system. These results show that there are some improvements to be made in the case of error handling and avoidance to make the system easier to learn and adapt.

Research Question 3: What are the educators' recommendations regarding the usability of the Moodle LMS?

Interview data was used to determine recommendations of educators on what to do to improve the usability of the Moodle LMS at the NIT. The researchers interviewed 35 users and data was treated through content analysis. Results revealed several functionalities as most useful in the Moodle LMS.

The educators mentioned that the system was easy to use and navigate. It was easy to upload content and the assessment was much easier even for large classes. Furthermore, the system offered technical assistance and allowed for time saving via recorded classes, marking and grading modules where by the system marks and grades assessments and quizzes

automatically. One of respondents had this to report: "there is ease of creating and assessing quizzes and assignments in case of large number of students. Lesson preparation and uploading PowerPoint presentations is also easy." Another respondent reported that:

> I like that the system is easy to use and has sufficient and reliable technical assistance for system use. I also like how it can save time for explaining lectures and having more time for practical. It is a real time application that simplifies work and increases productivity while enabling you to store and retrieve files in case of loss.

One more respondent revealed, "It is built with simple interface which allows me to navigate into various parts of the system. It is easy to use. The design is superb and the layout is so attractive."

While the educators found the system somewhat usable, there were some issues, that they pointed out during their interviews. The respondents recommended that navigation be improved by reducing the number of steps in preparation of quizzes and increasing clarity of links and buttons. They also suggested that a search function should be added to make it easier for teachers to find specific contents. For instance, one respondent reported, "Links and icons should be relevant." Another respondent recommended that "The system input interface should be enhanced by adding images and color manipulators so that we can distinguish difficult objects when preparing

notes for students." Another respondent advised, "You need to reduce some steps in preparation of quizzes." Similarly, the study of Arshad et al. (2016) recommended reduction of steps in certain areas while using the Moodle LMS.

The respondents also noted that there were many default settings that remained unchanged and thus were not necessary as they only increased the system's complexity. By far, the most complex functionality was grading where users recommended that it should be simplified. Finally, it was noted that the system does not allow upload of large files. Educators recommended that the system's upload capacity should be increased. One of respondents held the view that "Reduce unnecessary processes and remove default settings from having to be changed." Another one had this to say: "Allow full environment for users to make adjustments/edition of contents and materials." One more respondent recommended that "we need more simplified grading settings," and another had this to say: "You should enable the system to upload major files, like picture easily, as in increase capacity of uploading big files."

The analysis of the data also revealed other recommendations, for instance, regarding content, where the Moodle LMS should have up-to-date, relevant and easy-to-understand content. A review process should be implemented to ensure that the content is accurate, relevant and appropriate. On layout, the Moodle LMS should have a user-friendly design that is consistent throughout the platform. The design should be optimized for ease of use and accessibility. On interaction, it was recommended that the Moodle LMS should support collaborative learning and communication between students and educators. The system should also have features such as discussion forums, messaging and group projects to support teaching.

Additionally, there were other recommendations given that were not concerned with the system's usability but which may enhance the way users interact with the system. These recommendations did not involve modification of the system i.e., solutions can be implemented without making changes to the existing system. These challenges may affect the effective implementation of the Moodle LMS at the NIT. Educators recommended that internet connectivity be improved in terms of availability and speed so as the system's responsiveness can be felt. It was also recommended that regular training should be conducted to all educators.

One respondent reported, "More training and practice is required." Another one said, "there is a need of having high speed of internet bundle for the system to run smoothly." One more had this to say: "I recommend strengthening the internet system of the institute for effective usability of the system."

Similar recommendations were made by other authors based on challenges found on the effectiveness and satisfaction of the Moodle LMS. Studies of Bhalalusesa et al. 2013; Kaylan et al. 2020; Mtebe & Raphael, 2018) indicated that internet connectivity posed a challenge to effective utilization of the Moodle and other LMSs. Poor Internet connectivity is one of the biggest hindrances against implementation of e-Learning systems as it causes the system to respond slowly.

Conclusions and Recommendations

The study presented research questions to identify attributes to be used for usability evaluation and use these attributes to determine usability issues in the Moodle LMS. Five attributes were identified namely Effectiveness, Memorability, Satisfaction, Learnability and Errors. The study highlighted and recommends the importance of considering errors as a usability attribute, as it is often overlooked in usability testing. By including errors in usability testing, developers can identify and address issues that may negatively impact users' experience. Although the system proved to be useful in terms of satisfaction, effectiveness and its ability to learn, the study found issues with navigation, content organization, layout, interaction, lack of feedback mechanisms, error handling and system support.

The study recommends that the Moodle LMS should focus on providing a user-friendly interface navigation, clear content, consistent layout and enhanced interaction. It should also implement adaptive designs and timely feedback to improve the usability of the Moodle LMS. The study further recommends adaptive design of the Moodle LMS that is customizable based on users' needs and preferences. Moreover, NIT should provide regular training to educators on how to use the Moodle LMS and improve the internet connectivity within the campus to ensure the availability and reliability of the system.

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