



RESEARCH PAPER

Evaluating the User Experience of a Gamification-Based Moodle LMS

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ABSTRACT

Gamification is the integration of game mechanics in non-gaming contexts, such as education, to enhance motivation and engagement. This study aimed to evaluate the usability of a gamification-based Moodle learning management system (LMS) by having 48 computer science students aged between 15 and 24 years perform tasks and provide feedback on the System Usability Scale (SUS). 29 participants provided feedback, with 18 having prior LMS experience and 11 reporting no prior experience. An Independent Samples T-Test determined that there was no significant difference in System Usability Scale scores between male and female groups or between experienced and non-experienced groups. This suggests that gender and prior experience with an LMS do not affect the perceived usability of a gamification-based Moodle LMS.

KEYWORDS eLearning, Gamification, Learning Management System, Moodle, System Usability, Scale Usability

Introduction

Learning is a fundamental process of acquiring new knowledge, skills, and attitudes. According to recent research in the field of educational psychology, learning is a dynamic and ongoing process that occurs throughout an individual's lifetime (Anon 2000). Traditional learning environments, such as classrooms and lectures, have been the primary method for delivering education for centuries. However, with the advancements in technology, eLearning has emerged as a new and innovative method for delivering education and training.

Gamification refers to the use of game design elements in non-game contexts such as education, marketing, and health. The integration of game-like features, such as points, badges, leaderboards, and challenges, into eLearning platforms has been proven to increase motivation and engagement among learners (Hamari, Koivisto, & Sarsa 2014). The integration of gamification into eLearning can create a more interactive and enjoyable learning experience for students, leading to increased motivation, engagement, and learning outcomes (Kapp 2012).

Literature Review

eLearning

eLearning, or electronic learning, refers to the use of digital technologies to support and enhance the learning process. This includes a range of activities, such as online courses, virtual classrooms, multimedia resources, and interactive simulations (Papastergiou 2009). eLearning has numerous benefits over traditional learning methods, including increased flexibility, convenience, and accessibility. It allows individuals to learn at their own pace,

from anywhere and at any time, making education more accessible and convenient for people with busy schedules or who are unable to attend traditional classrooms.

Learning Management System

A learning management system is a comprehensive software solution designed to manage the entire process of knowledge or skill-based course delivery, documentation, tracking, and reporting (Ghosh 2021). It enables the creation, tracking, and delivery of educational courses, training programs, and other learning activities, providing a centralized platform for the organization of all educational processes. The LMS also affords students the ability to prioritize their workload and effectively manage their learning experience (Anon 2023.). The history of learning management systems is not long. Learning management systems have gained in popularity in recent years. The teaching-learning process has been transformed by technology advancements. The origin of LMS can be traced back to the invention of the teaching machine in 1924 by Sidney Pressey, considered to be the world's first LMS. This device resembled a typewriter with two windows, one for displaying questions and the other for answering them (Sulun n.d.).

Usability Evaluation

Usability can be defined as the degree to which a system, product, or service can be utilized by a specific user to attain their specified goals in a particular usage context, with effectiveness, efficiency, and satisfaction. The term "specified" refers to the specific combination of users, goals, and usage context being evaluated for usability. Additionally, usability can refer to the design elements, competencies, and actions that contribute to the overall usability of a system, product, or service." (Anon 2018). Usability evaluation is crucial as it promotes human-centered usage of systems by enhancing user satisfaction, reducing development costs, and minimizing negative perceptions towards the system. There is a vast array of evaluation tools and techniques available in the literature to identify usability flaws and improve usability. Usability testing is essential for any software system, including learning management systems used in educational settings, as the quality of the LMS will directly impact the quality of learning (Şenol et al. 2014).

Usability testing is a process used to evaluate the user-centered design of a system, product, or service. During the testing session, a researcher, known as a facilitator or moderator, instructs participants to perform specific tasks using one or more user interfaces. The researcher then observes the participants' behavior and gathers feedback as they complete the tasks. The objectives of usability testing can vary depending on the specific study. The usability testing process involves three main components: the facilitator, the tasks, and the participant. The facilitator assigns tasks to the participants and observes their behavior, collecting feedback as they complete the tasks (Moran 2019).

Material and Methods

The aim of this research was to assess the usability of a gamification-based Moodle learning management system. The study utilized the user testing method of usability evaluation, which involves the participation of designated users who are assigned a series of tasks to perform using the system. Upon completion of these tasks, the users were asked to provide feedback regarding their experience using the system. This approach to usability testing is deemed to be the most beneficial technique due to its direct and focused nature.

System Usability Scale

The SUS is a usability measurement tool developed by John Brooke in 1986 while working at Digital Equipment Corporation in the United Kingdom. SUS has since been employed in over 1,200 published studies to evaluate the usability of a wide range of

products, including websites, mobile applications, desktop applications, interactive voice response systems, and many more (Tullis 2018). The items of the SUS are;

- I think that I would like to use this system frequently.
- I found the system unnecessarily complex.
- I thought the system was easy to use.
- I think that I would need the support of a technical person to be able to use this system.
- I found the various functions in this system were well integrated.
- I thought there was too much inconsistency in this system.
- I would imagine that most people would learn to use this system very quickly.
- I found the system very cumbersome to use.
- I felt very confident using the system.
- I needed to learn a lot of things before I could get going with this system.

SUS is a concise evaluation tool that consists of ten items rated on a five-point scale, ranging from strongly disagree to strongly agree, with five positive and five negative statements. The SUS score is a single numerical value between 0 and 100, which makes it easily understandable. Despite its brevity and small sample size, SUS has proven to be a reliable measure of system usability. It can be utilized to evaluate the usability of any software system, device, or service, and is considered "technology agnostic." One of the key advantages of SUS is that it is freely available for use (Orfanou, Tselios, & Katsanos n.d.). SUS has now become an industry standard (Sauro 2011).

Participants of the Study

The usability testing of the developed learning management system was carried out during the latter half of 2022 at the Balochistan Residential College Turbat and the University of Turbat, in Pakistan. Participants of the study consisted of students from diverse education levels and age groups, which enabled a comprehensive evaluation of the system's usability. The students belonged to the different areas of the Balochistan province, and studying at school, college, and university levels. The inclusion of students from a wide range of educational backgrounds and ages provided valuable insights into the system's usability.

This study selected 48 test users to participate in the usability testing process. The number of participants in a usability test is influenced by various factors, and the selection of participants is crucial for the success of the study. The 5-users rule, also known as the "5 magical number," suggests that 5 users of a usability test can uncover almost 80% of the issues in a system, including learning management systems. This is considered to be the standard number for usability studies (CAROL M. BARNUM 2008). To detect a higher percentage of problems in the system, a minimum of 15 users is typically required (Laurie Faulkner 2004). The optimal sample size for usability testing remains a topic of debate among experts. However, a sample size of 15 users provides better results compared to a sample of just five (Nielsen and Landauer n.d.). On the other hand, (Alroobaea and Mayhew 2014) recommend a minimum sample size of 12 users and a maximum of 20 users for usability testing. It is important to note that the appropriate sample size may vary depending on the specific goals and constraints of a usability study.

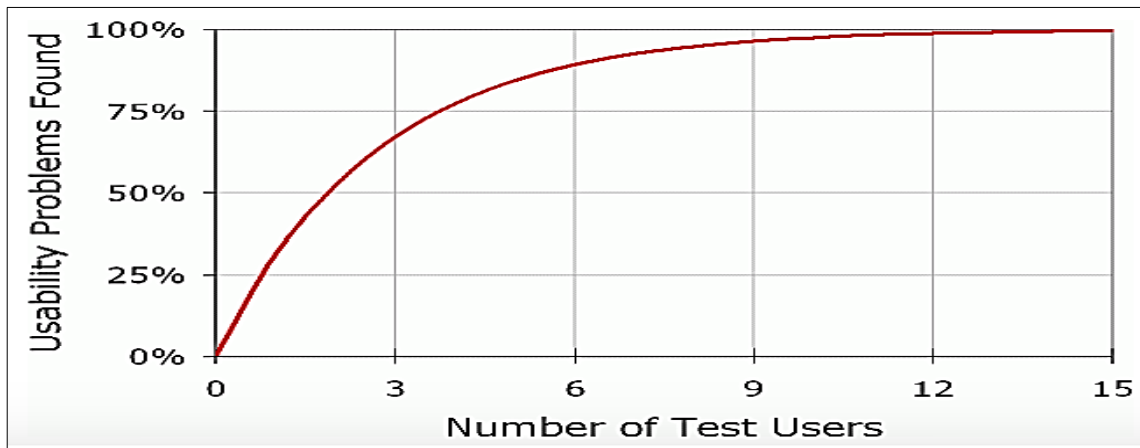


Figure 1. Number of Test Users with the Ratio of Usability Problems Found Source: (Laurie Faulkner 2004)

This highlights the importance of selecting an appropriate sample size for usability tests, as the number of participants directly affects the outcome of the study.

Usability Tasks

The test participants were instructed to complete a series of tasks related to the use of a gamification based LMS. They were asked to visit the LMS, initiate the signup process either through self-registration or email registration facilitated by the administrator, and log in to the system after successfully completing the signup process. This task was designed to assess the ease of use and user experience of the LMS signup and login processes.

Log in to Learning Zone Learning Management System

Username

Password

Log in

Lost password?

Is this your first time here?

For full access to this site, you first need to create an account.

Create new account

Figure 2. Login Page of the LMS

Once the participants had successfully logged in to the LMS, they were instructed to access the course entitled "Microsoft Word" and enroll in the course. To facilitate the enrollment process, the self-enrollment option was made available to the participants.

Following enrollment, the participants were then asked to engage with the resources and activities available within the course, in order to evaluate the functionality and usability of the LMS as a platform for gamification of eLearning. This step was designed to assess the participants' experience using the various features and tools within the LMS course environment.

Moodle, a widely used LMS, structures course content into two main components: resources and activities. These components serve as the building blocks for creating a course in Moodle. A resource is any item that a teacher can use to assist students in their learning process, such as a file or a link. Moodle offers a comprehensive array of resource types, providing teachers with a range of options to incorporate into their courses. Students can access and utilize these resources to view or download course content and information. An activity, on the other hand, generally refers to a collection of Moodle course features that enable student interaction and participation. Activities support collaborative learning and teaching and may involve interactions between students and teachers or between students themselves. Many activities in Moodle are designed to be graded, allowing for assessment of student performance.

The idea behind gamification in Moodle is to create a more interactive and engaging environment for students. This is achieved by adding game-like features to the learning process, such as points, badges, and leaderboards, that reward students for their participation and progress. This type of motivation has been shown to increase engagement and improve the overall learning experience (Sailer et al. 2017).

Gamification Components

The components of gamification used in the Moodle LMS for usability evaluation include:

Chat: The chat feature in Moodle was used to encourage collaboration and communication among students. This was gamified by using a point system to reward students for active participation in the chat.

Forum: The forum feature in Moodle was gamified by using a point system to reward students for starting new discussions, contributing to existing discussions, or answering questions. This aimed to encourage students to engage in meaningful discussions and increase their participation in the forum.

Quiz: The Quiz feature in Moodle was gamified by using points by the LMS to reward students for completing quizzes or achieving high scores. The idea was to increase motivation and encourage students to take the quizzes seriously.

Leaderboard: The leaderboard tool in Moodle was used to display the scores or rankings of students based on their performance in various activities, such as quizzes, forums, and chats. This can add a competitive element to the learning experience and encourage students to work harder to achieve higher scores and move up the leaderboard.

Data Collection

In order to evaluate the usability of the Learning Zone LMS, a SUS measurement tool was utilized following the practical use of the LMS by test users. The respondents were asked to provide their level of agreement with a series of statements regarding the system, using a five-point Likert scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5).

Data Interpretation

The collected data underwent analysis to calculate the SUS score according to established measurement procedures (Andrew Smyk 2020). The steps involved were as follows:

Step 1: The scores for all odd-numbered statements (1, 3, 5, 7, and 9) were summed and 5 was subtracted from the result.

Step 2: The scores for all even-numbered statements (2, 4, 6, 8, and 10) were summed, and this total was subtracted from 25.

Step 3: The sums from Steps 1 and 2 were added and multiplied by 2.5 to obtain the SUS score for the respondent.

Results and Discussions

Demographics of the Respondents

Usability testing of the learning management system was conducted to ensure its usability. Out of the 48 test users, 29 (60%) test users voluntarily provided their feedback.

Table 1
Gender-wise Distribution of the Respondents

Gender	Frequency	Percent
Male	24	82.8
Female	5	17.2
Total	29	100.0

The results of the study indicated that a disproportionate number of participants were male, with 24 out of 29 (82.8%) identifying as such, while only 5 out of 29 (17.2%) identified as female. This disparity in gender ratios can be attributed to the higher enrollment of male students in the relevant courses.

Table 2
Age-wise Distribution of the Respondents

Age Level	Frequency	Percent
15-24 Years	29	100.0
25-34 Years	0	0
35 Years or Above	0	0
Total	29	100.0

For the purpose of this study, three age groups were established, with all participants falling within the age range of 15 to 24 years. This was reflective of the fact that all respondents were either undergraduate students or of a lower academic level.

Table 3
Education Level-wise Distribution of the Respondents

Education Level	Frequency	Percent
SSC	4	13.8
HSSC	5	17.2
Under Graduate	20	69.0
Total	29	100.0

In this study, all of the test participants were students majoring in Computer Science. Out of the 29 respondents, 69% were Undergraduates and 31% were comprised of HSSC Computer Science (17.2%) and SSC Computer Science (13.8%) students.

Table 4
Respondents' Experience Groups

Prior Experience	Frequency	Percent
Yes	18	62.1
No	11	37.9
Total	29	100.0

The educational system in Pakistan saw the implementation of learning management systems to a certain extent during the Covid-19 pandemic. Of the 29 respondents, 18 (62.1%) reported prior experience using a learning management system, while the remaining 11 (37.9%) reported no prior experience with such systems.

Significance Differences in Means

The Independent Samples T- Test is a statistical test used to compare the means of two independent groups in order to determine the significance of difference between the associated populations. The test requires two key variables: the dependent variable, also known as the test variable, and the independent variable, also known as the grouping variable.

The present study employed the Independent Samples T-Test to determine the significance of the difference in mean scores between two gender groups with regards to their Perceived SUS scores.

Table 5
Participants' Gender-wise Means

Group Statistics					
	Gender	N	Mean	SD	Std. Error Mean
SUS	Male	24	77.91	8.95	1.82863
	Female	5	72.50	5.30	2.37171

This investigation sought to examine whether there was a statistically significant difference between the means of the two gender groups (male and female) as the independent variable.

Table 6
Participants' Gender-wise Significance of Means Differences

Independent Samples T-Test			
T	Df	Sig. (2 tailed)	Mean Difference
1.29379	27	.206698	5.41667

The results indicated that there was no significant difference, as evidenced by the t-value of 1.29379 and a p-value of 0.206698. This finding suggests that the mean scores of male (M=77.91, SD=8.95) and female (M=72.50, SD=5.30) groups did not differ significantly with respect to system usability.

A separate t-test was performed to investigate the difference in perceived System Usability Scale scores between two different experience groups.

Table 7
Participants' Experience Groups Means

Group Statistics					
	Experience	N	Mean	SD	Std. Error Mean
SUS	No	11	78.18	11.46	3.45574
	Yes	18	76.25	6.60	1.55575

Table 8
Participants' Experience-wise Significance of Means Differences

Independent Samples T-Test			
T	Df	Sig. (2 tailed)	Mean Difference

0.5787	27	.567588	1.93182
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The results indicated that there was no significant difference between the scores of the experienced group (M=778.18, SD=11.46) and the non-experienced group (M=76.25, SD=6.60), as indicated by the t-value of 0.5787 and the p-value of 0.567588. These findings suggest that there is no significant difference in the mean scores for system usability between the experienced and non-experienced groups.

The present study utilized a One-way Analysis of Variance (ANOVA) statistical test to investigate potential differences in mean scores among three distinct education level groups. It is a statistical method used to determine whether there exists a significant difference between the means of two or more independent groups. In a one-way ANOVA, there are two key variables involved: (1) the dependent variable, which is the variable of interest, and (2) the independent variable or grouping variable, which is used to divide the data into the different groups being compared.

Table 9
Group-wise Significance of Means Differences

ANOVA					
SUS					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1087.554	2	543.777	14.25	.000
Within Groups	992.187	26	38.161		
Total	2079.741	28			

The results of the one-way ANOVA indicated a statistically significant difference between the groups, with an F-statistic of 14.25 and a p-value of 0.001 (F (2,26) = 14.25, p = 0.001). This suggests that at least one of the group means is significantly different from the others.

Table 10
Participants' Education Level Significance of Means Difference

Multiple Comparisons				
Dependent Variable: SUS				
(I) Education Level	(J) Education Level	Mean Difference (I-J)	Std. Error	Sig.
SSC	HSSC	.25000	4.14397	.998
	Under Graduate	13.37500*	3.38354	.001
HSSC	SSC	-.25000	4.14397	.998
	Under Graduate	13.12500*	3.08873	.001

*. The mean difference is significant at the 0.05 level.

The results of a Tukey post-hoc test revealed significant differences in the means of the SSC and Undergraduate education level groups (p = 0.001) and the HSSC and Undergraduate education level groups (p = 0.001). Conversely, no statistical significance was observed between the means of the SSC and HSSC education level groups (p = 0.998).

User Satisfaction

User satisfaction is an important metric in usability testing of a LMS because it reflects the overall user experience and determines the acceptability and success of the LMS. A satisfied user is more likely to use the LMS regularly and effectively, leading to better learning outcomes. High user satisfaction can also contribute to the overall perception of the quality and value of the LMS, leading to increased adoption and support from stakeholders.

The present study employed the System Usability Scale as a metric to assess user satisfaction with regards to the usability of the LearningZone LMS. User satisfaction was quantified through the computation of SUS scores, as illustrated in the below table;

Table 11
SUS Analysis Summary

	N	Minimum	Maximum	Mean
SUS	29	65.00	95.00	76.98

A study was conducted involving 29 test users to evaluate the usability of the LearningZone LMS. The results were measured using the SUS scores, which ranged from 65.00 to 95.00. The average Mean SUS score was 76.98, which falls within the category of "good".

Table 12
SUS Frequencies and Percentage of Response

SUS	Frequency	Percent
65.00	4	13.8
67.50	1	3.4
70.00	3	10.3
72.50	4	13.8
75.00	3	10.3
77.50	4	13.8
82.50	3	10.3
85.00	2	6.9
87.50	2	6.9
90.00	1	3.4
92.50	1	3.4
95.00	1	3.4
Total	29	100.0

In this study, all participants expressed a positive perception of the LMS, evidenced by the high scores they received on the System Usability Scale. The SUS is a commonly used tool to measure the usability of a system and consists of a 10-item questionnaire that ranges from 1 to 4 in terms of agreement. The scores received by the participants in this study ranged from 65.00 to 95.00, indicating a high level of user satisfaction.

Table 13
SUS Grades, Adjectives and Acceptability Ranges

Grade	SUS	Adjective	Acceptable
A+	84.1-100	Best Imaginable	
A	80.8-84.0	Excellent	
A-	78.9-80.7		
B+	77.2-78.8		Acceptable
B	74.1-77.1	Good	
B-	72.6-74.0		
C+	71.1-72.5		
C	65.0-71.0		
C-	62.7- 64.9	OK	Marginal
D	51.7-62.6		Acceptable

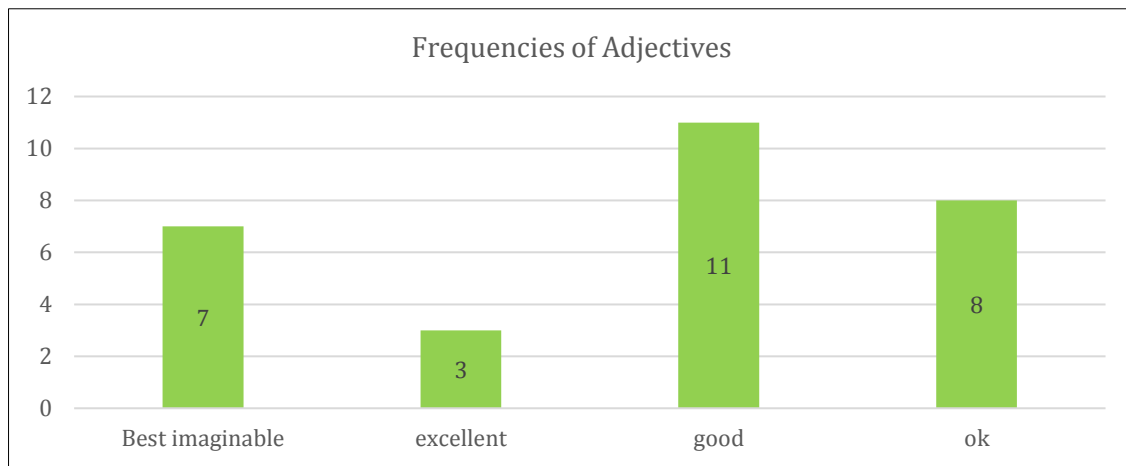


Figure 4. Frequencies of Adjectives of Usability Testing

The majority of the respondents viewed the LMS positively, as 07 participants considered the LMS to be the "Best Imaginable", 03 considered it to be "Excellent", 11 considered it to be "Good", and the remaining 08 respondents considered it to be "Ok". These results suggest that the majority of the participants had a positive experience with the LMS. This highlights the overall effectiveness of the LMS in providing a positive learning experience for the users.

Conclusion

Gamification in eLearning refers to the integration of game design elements in eLearning to increase motivation and engagement among learners. It involves incorporating features such as points, badges, leaderboards, and challenges into eLearning platforms to make the learning experience more interactive and enjoyable. A learning management system is a software solution used to manage the delivery and documentation of educational courses and training programs. Usability evaluation is crucial in promoting the human-centered usage of systems and enhancing user satisfaction, and usability testing is a process used to evaluate the design of a system and gather insights into the behavior and preferences of users.

This study aimed to evaluate the usability of a gamification-based Moodle eLearning system enriched with gamification through conducting a usability testing with 48 participants. The demographic information of the participants was analyzed and showed a disproportionate ratio of male participants (82.8%) compared to female participants (17.2%). All participants fell within the age range of 15 to 24 years and the majority of them were Undergraduates (69%). In terms of prior experience using a learning management system, 18 participants (62.1%) reported having prior experience while 11 participants (37.9%) reported no prior experience.

The study employed Independent Samples T-Test to determine the significance of the difference in mean scores between male and female groups as well as experienced and non-experienced groups in regards to their Perceived System Usability Scale scores. The results indicated that there was no significant difference in the mean scores between male and female groups and between experienced and non-experienced groups, suggesting that gender and prior experience did not significantly impact the participants' perceived system usability.

Recommendations

Based on the results and discussion of the study on the Usability of the learning management system, the following recommendations are made:

Gender-Based Differences: The results of the study showed no significant difference in the mean scores between male and female groups with regards to their Perceived System Usability Scale scores. This suggests that the LMS is equally usable for both male and female users.

Experience-Based Differences: The results of the study indicated that there was no significant difference in the mean scores between experienced and non-experienced groups in terms of the system usability. This suggests that the LMS is user-friendly, even for those who have never used a learning management system before.

Age Group: The study found that all of the participants were students in the age range of 15 to 24 years, which is reflective of the lower academic level of the sample group. The results indicate that the LMS is suitable for students in this age range.

Educational Level: The study found that the sample group consisted of students majoring in Computer Science, with the majority of the participants being undergraduates. The results suggest that the LMS is suitable for computer science students at all academic levels, including SSC and HSSC students.

In conclusion, the results of the study suggest that the learning management system is user-friendly and suitable for students of all ages, educational levels, and experience levels. The recommendations provided aim to further enhance the usability and user experience of the LMS.

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