Gamified Collaborative Environment in Moodle

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ABSTRACT
Higher education institutions are struggling to enhance teaching and learning processes to support students’ needs in this information age. In the last few years, gamification has been widely used to improve learning experiences in various environments. Education is one of the fields that adopted gamification as technological innovation to increase student engagement since it plays a critical role in higher education, especially in digital learning environments. Today, learning management systems (LMSs) are commonly used to facilitate learning processes. However, the engagement and the motivation of students when using such systems require extra attention. There is a need for an instructor to incorporate digital technologies with esteemed innovations to create an engaging learning environment. Increasing students’ engagement is said to be evidence of increased learning. Therefore, this paper addresses these challenges by designing, developing, and evaluating a gamified collaborative discussion environment on the moodle LMS. To achieve this, the students in a postgraduate course used a gamified online discussion environment for eight weeks during group work to complete their term projects. Students’ online learning pre-test and post-test data are utilized to investigate students’ engagement in a gamified discussion environment. The results illustrate that there is a significant difference between pre-test and post-test results, which shows that the gamified online discussion environment has improved students’ engagement. Furthermore, students that highly accessed the online course activities had a good engagement, which motivated students to conduct online collaboration according to the game-feature context.

INDEX TERMS
Gamification, collaborative environment, online discussion environment, moodle.

I. INTRODUCTION
Information and communication technologies (ICTs) are effectively used in higher education. However, there is a need to continuously evaluate and monitor their contributions to the teaching and learning processes. Over the last decades, the standards of higher education have confirmed the potential value of a student-centered learning approach in which students are all highly engaged and improve their learning processes [1], [2]. Web 2.0 and internet technologies have caused higher educational institutions to use different learning approaches such as blended learning or flipped classrooms.

The use of digital technologies promotes collaborative learning in blended learning environments. In general, a blended learning approach that combines the traditional classroom approach and digital learning approach is considered as the significant trend in today’s higher education. Various studies that are focused on the difference between blended learning strategies and practices explore the differences of the blended learning practice mode [3]. In a blended learning approach, various tools and resources are used, including recorded lecture videos, online assessments, e-Portfolios, online tutorials, wikis, and online discussions to improve students’ interaction [4].

The Moodle LMS has been designed to enable instructors to develop online courses that foster students’ participation in an interactive and collaborative environment. The main aim of Moodle is to help the instructors to provide better opportunities to present the knowledge and for support in acquiring knowledge, skills, and experiences. Moodle plays a crucial role in providing flexibility to support students’ requirements, engagement, and motivations [5], [6]. The improvement of students’ engagement in higher education is perceived as a perennial problem since the format of the classroom teaching environment is not recognized as an interactive environment that promotes active participation and engagement. Meanwhile, providing access, delivering information, and illustrating the key concepts in higher education can improve the interaction and communication between the instructors and students.
the learners. The enhancement of student engagement plays a critical role in creating better learning strategies [7].

Online discussions have developed and been used in different learning contexts [8]. The main benefits of online discussions include the promotion of a sense of community through the learners, sharing knowledge, the development of higher-level thinking and improving active participation and student engagement. When the learners actively share ideas, contribute, and discuss with their peers, this means that they learned the required information and constructed their knowledge resources. Furthermore, the instructors tend to develop the gamified approach to support student collaboration, participation, and sharing their experiences with their peers.

Currently, gamification has been established as a new approach in education in general, teaching, and learning more specific knowledge [9], [10]. The central concept behind gamification is to integrate game elements in a nongame environment. Furthermore, increasing the potential to improve student engagement and motivation encourages researchers to develop and adopt gamification in educational contexts with various approaches [11]. Gamification tends to improve student engagement in virtual learning environments by using several game elements such as badges, points, levels, and leaderboard [12]–[14].

Due to the lack of student engagement, the main aim of this study to determine the impact of gamifying a familiar online discussion environment on student engagement through the Moodle platform. In particular, we demonstrate the implementation of a gamified Moodle and how to increase engagement in online discussion environments in higher education.

II. STUDENT ENGAGEMENT IN ONLINE DISCUSSION ENVIRONMENTS

Digital technologies have reshaped face-to-face interactions and replaced them with online technologies.

Student engagement is an essential component of digital learning, which has a high impact on academic performance [15]. Course materials, instructional tasks, information overload, the interface characteristics of classroom management, and student roles are the main factors that affect student engagement in online learning environments [16].

Various strategies for student engagement in the classroom environment have been considered. Student engagement can be classified into three different categories: (1) behavioral engagement (BE), (2) emotional engagement (EE), and (3) cognitive engagement (CE) [17]. Behavioral engagement represents students’ participation and engagement in classroom resources/activities. Meanwhile, emotional engagement illustrates students’ positive and effective responses to assignments, instructors’ questions, and academic activities. Cognitive engagement shows how students solve the problems and think creatively in their academic activities. The three accepted component models of student engagement include behavioral, cognitive, and emotional engagement [18]. Behavioral engagement is about students’ participation in learning activities, homework completion, and following classroom rules [19], while behavioral engagement is defined as student effort, participation, persistence, attention, and positive attitudes in learning activities [20].

Online discussion environments play critical roles in improving student interaction and collaboration in an educational context [21]. They provide an opportunity for students who have not contributed to the classroom environment or are shy to participate and engage through posting questions or answers when they feel more comfortable. Online discussion environments also enhance collaborative learning by allowing the sharing of experiences and knowledge and facilitating participation and communication [22]. Online discussion environments include many indicators that measure a student’s behavioral engagement, such as the number of posts, the duration that is spent on creating and reading discussions, and the number of logins to the discussion environments. [23], [24]. There is a significant relationship between learning and discussion posts [25]. According to the relationship between learning and discussion, posts occur when discussions are wanted. Their results show that whenever a discussion post is voluntary, four discussion posts were developed and created by thirty-two undergraduate students throughout the whole semester [26].

III. GAMIFICATION IN MOODLE

The recent developments in internet and communication technologies offer new opportunities for various sectors in general [27] and especially for the education sector worldwide. Accordingly, many higher education institutions are continuously adopting digital learning mechanisms [28].

The emergence of gamification started in the early 2000 [29]. Gamification is defined as using game-design elements and rules in the form of nongame formats, which is considered as a new context. The main aim of gamification is to promote students’ performance and motivations related to a given activity. Gamification in the educational context is presented to the students in a new and immersive experience that is based on motivation while changing traditional learning into interactive learning [54].

Gamification concentrates on using game-design elements and game thinking to enhance student engagement and motivation [30]. Using leaderboards, levels, progress bars, badges, time, and completion restrictions on activities are considered as critical components of game elements and mechanics [31], [32], [52]. However, any application that integrates game mechanics and game elements with proper instructions can be known as a gamification environment [33].

Most of the existing experimental studies have shown that the gamification has a significant influence on students’ engagement [12], [34], motivation [10], and learning outcomes [35]. However, some researchers reported negative results related to gamification, such as less satisfaction, motivation, and empowerment [11].

The Moodle LMS is one of the most popular LMSs today, and it is widely used to improve students’ collaboration
TABLE 1. Game mechanics features in a gamified environment.

<table>
<thead>
<tr>
<th>Game Mechanics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
<td>User profile</td>
</tr>
<tr>
<td>Level</td>
<td>Represents the user level</td>
</tr>
<tr>
<td>Leaderboard</td>
<td>Ranking of students’ performance</td>
</tr>
<tr>
<td>Points</td>
<td>Measuring units of the students’ performance with respect to task completion</td>
</tr>
<tr>
<td>Badges</td>
<td>Signs of completion that are awarded by completing a specific task</td>
</tr>
<tr>
<td>Progress Notification</td>
<td>An indication of which activities have been completed</td>
</tr>
<tr>
<td>Performance Graphs</td>
<td>Visualization of student activity</td>
</tr>
<tr>
<td>Teams</td>
<td>Groups of students that are structured to fulfill the relevant goal</td>
</tr>
<tr>
<td>Social Feedback</td>
<td>Students’ interaction with other student activities</td>
</tr>
<tr>
<td>Quests</td>
<td>Predefined targets that students should reach by achieving activities</td>
</tr>
<tr>
<td>Chats</td>
<td>Enables students to chat with each other</td>
</tr>
</tbody>
</table>

in online learning environments [50]. The advantages of using Moodle LMS include sharing information with the students, facilitating access to course materials, announcing and collecting course assignments, enhancing students’ engagement through online discussions and providing distance learning classes [36], [37]. Furthermore, Moodle’s flexibility and user-friendly interface provide the ability to develop a gamified learning environment. The Moodle platform supports the integration of game elements such as time restrictions, badges, leaderboards, chatrooms and discussion forums, activity completion indicators, progress bars, scoreboards, plugins, restricted access and points [36], [43], [53]. Empirical research studies have proven that the use of gamification in Moodle tends to improve students’ motivation and engagement [38].

Customizing the Moodle platform can offer certain features. The Moodle block can be used to add engagement features, such as instance progress bars, level ups, stashes, chats, GISMO and badge blocks [39], while the Moodle resources and activities can be used to add lessons, H5Ps, quizzes, Login access data, labels, and questionnaires [40], [31]. Game mechanics have positive influences on supporting students to achieve better academic outcomes [13]. In general, game mechanics provide a structured set of objectives for performing tasks and gaining rewards to complete their activities, as shown in table 1.

FIGURE 1. Showing the lessons in the gamified moodle.

IV. DESIGN AND IMPLEMENTATION OF GAMIFIED MOODLE ENVIRONMENT

The gamified online discussion environment that was developed for this study consists of the discussion board, which includes posting, reading, updating and commenting; and the features that were developed based on the gamification features, such as experience points, badges, progress bars, leaderboards, and awards, which are used to measured its impact on students’ engagement.

A. THE MAIN SITE PAGE

There are many features that are configured on the main page, such as the navigation board, which consists of the dashboard, site page, calendar and all necessary navigation boards that are concerned with the blocks, resources, and activities that encompass the users’ gaming experience in a gamified platform.

B. DEVELOPING GAMIFIED LESSONS ON MOODLE

The main course page is developed and it applies various resources and activities. Each resource and activity has their own respective configurations. According to the gamified online discussion environment, the model consists of (7) topics, as shown in the figure below.

In the above figure, the topics have assigned to (7) different activities, including the term project specifications, term project group, engagement environment, presentation submission 1, engagement environment, presentation submission 2 and submit final project. Each topic has its own vital features and restrictions based on the gamified environment.

C. COMPLETION PROGRESS

Completion Progress is a Moodle block and time-management tool that follows the contents of academic activities. Furthermore, it shows the applied course activities and visualizes the practiced activities and resources of
participants. By placing the mouse pointer on the bar, the activity status will be shown. As usual, the completion progress takes place on the top right-hand side of the main course page, as shown in the figure below.

The completed progress is represented in different colors to denote if the activity has been completed or not. The figure below is a screenshot from the recent study illustrating which activities have been completed. The green color represents the completion of the participant’s course activities, while the blue color indicates that the participants did not finish the course activity.

D. LEVEL UP

Level up is a Moodle block and is considered as an essential tool to gamify the course activities by providing the participants with Experience Points (XPs), which represent the participant’s progress. Furthermore, it shows the new progress levels of participants and what they have remaining to pass to the next level. The primary purpose of using the Level up block is to incentivize participants to follow their learning experience and motivate them to complete their course activities.

The Level up plays a critical role in the gamified environment because it includes five essential game elements such as Experience Points, Leaderboards, Levels, Progress, and Badges. The figure below illustrates the leaderboard contents. The level tabs demonstrate the number of levels that have been passed by the participants. The participant tab shows the all the users that have participated in the gamified Moodle. Moreover, the total numbers of XPs below represent the participants’ points that they earned from their course activities while the progress bar illustrates the required points to pass to the next level.

E. GISMO ANALYTICS

GISMO is a graphical performance monitoring tool that provides the ability to visualize a student’s performance on academic activities in the online environment. Furthermore, by using GISMO, the instructor is able to follow and check the various aspects of a student’s performance such as the student accessing course activities, submitting assignments, applying and completing discussion forms, and reading course contents. The significance of using GISMO is that it provides an overall graphical overview of online courses and not just that of a particular student or specific activity. In the present study, GISMO is used to examine the participants’ log-ins, access overviews, assignments, and forum access and show the completion of assignments, discussions, and resources by the students.

Currently, gamification plays a significant role in improving students’ engagement in blended learning environments. Gamification is supported with LMSs, which provide the instructor both online learning and traditional face-to-face instruction. This research strives to adopt a gamified online discussion form to improve students’ behavioral engagement in blended learning environments.

F. GAME MECHANICS

Game mechanics are defined as techniques that specify the rules and strategies, which are designed to improve their interaction, motivation, and engagement [41]. In this study, game mechanics refer to the mechanisms that create game elements using Moodle’s settings and features. Furthermore, the main game mechanics are the completion tracking of course activities, creating a post, updating, and reading and specifying points for the completion of activities [31]. The key concept behind game mechanics is to use game elements...
such as progress bars, level ups, leaderboards, and badges to improve the learning experiences of students [42].

In our study, the gamified online discussion environment was applied for 8 weeks during the spring semester of the 2017-2018 school year. First, pre-test questionnaires were given to examine students’ engagement before applying to the gamified collaborative environment. The study used a specific game mechanics strategy with game elements to adopt the gamified online discussion environment. In general, the gamified environment consists of (9) levels such as the pre-test questionnaire, term project specifications, term project group, engagement environment, presentation submission 1, engagement environment, presentation submission 2, submit final project and post-test questionnaire, and each level has specific mechanics and rules.

The completion tracking is configured for the online gamified course to track students' activities. The students should first apply for the term project specifications, which consist of (7) sublevels, as shown in the figure below.

When the students are watching the instructional video that was designed and created using the H5P interactive Moodle plugin, the student cannot apply for the Suggested Research Area unless the instructional video is marked as a completed activity. The student will not be able to access the Harvard referencing guideline file until the suggested research area is completed. Therefore, the restriction related to completion is a feature of the game mechanics that motivate students to follow and complete all the required course activities.

Afterwards, all the activities of the term project specifications are marked as completed and the points (XPs) that are required to pass to the next level are earned. The Level up Moodle plugin provides impressive game mechanics that allow for collect the required experience points to move to the next level, as shown in the figure below. A student can earn XPs when another activity is completed.

In this study, as shown in the figure, level one starts at 0 XP. A student at level one needs to collect 50 XP to pass to level two, a student at level two needs to collect 100 XP to get to level three, and a student at level three needs to collect 150 XP to pass to level four. A student at level four needs to gain 300 XP to pass to level five, a student at level five needs to get 400 XP to pass to level six, and a student at level six needs to collect 550 XP to pass to level seven. A student at level seven needs to collect 650 XP to pass to level eight and a student at level eight needs to collect 750 XP to pass to the last level.

After the student has accessed the term project specifications, he or she earns a required point. Then, the student is able to pass to another level, which is the term project group. In this level, students should select their group and mark this task as completed to gain access to the engagement environment level. The groups are distributed into two groups, which are Ph.D. and MSc. Each group for the Ph.D. should have one student per group, while for the MSc, three students can belong to 1 group with one student specified as the group leader.

In the engagement environment, the student should create two posts, update two posts, and read the posts to be engaged in the environment. After completing the activity and gaining enough points, participants are expected to submit presentation submission 1 online and move to the next activity level.

The completion progress is used to monitor the students’ activities. The completion progress is a feature of the game mechanics that provides the ability to show which activities have been completed and which activities have not yet been completed. In general, this mechanics helps to motivate the student and complete their activity while following their peer’s completion progress.

After completing the engagement environment and presentation submission 1, the student should apply for engagement environment 2; post, update and read their own and peers’ discussion posts; and collect the required points. After this, students will be able to access and submit their second
FIGURE 8. Part 1 of the gamified online discussion environment.

FIGURE 9. Part 2 of the gamified online discussion environment.

presentation through presentation submission 2. Afterwards, Submit final project will be active, and students can access the module to submit their final projects.

Aside from that, the student should access the post-test questionnaire that was added to the Moodle. Two questionnaires were developed to examine students’ engagement and performance before and after applying to the gamified online environment. Meanwhile, all the logs of data of the students are stored in the Moodle system.

V. RESEARCH METHODOLOGY

In this study, an exploratory method design was utilized based on the online discussion environment. The pre-test and post-test questionnaires were used to investigate the students’ engagement in an online environment. Twenty (20) different questions have been prepared that were taken from AUSSE, 2011, [44] and [45] and are measured on a 5 point Likert scale. The questions were then added to the online course page.

Furthermore, the questionnaire was used to evaluate the changes in online student engagement throughout the academic semester. Students were provided with a pre-test questionnaire about their engagement before using the online environment. Students were provided with the post-test questionnaire that measured their engagement after using the online environment. The t-test is used to compare the pre- and post-test results to assess if the gamified online discussion environment impacted student engagement.

VI. DATA COLLECTION

Forty-one (41) students (7 females and 34 males) out of (45) students participated in the recent study. The participants were took a graduate level (MSC and Ph.D.) Management Information System (MIS) course at a University in the northern part of Cyprus, which is a large private university in north Cyprus - Turkey. The course instructor and the researcher conducted and followed the study.

The gamified online discussion environment was applied for (8) weeks during the spring semester of the 2017-2018 academic year. First, the participants should answer the pre-test questionnaire so that we can examine student engagement before applying the gamified online environment. Furthermore, the students should complete the term project specification. Then, they can select their group member(s) for their term project, and the groups are split into two types, which are Ph.D. and MSc. In the Ph.D. groups, each group should have one student per group, while for the MSc groups, three students can be in 1 group with one of them specified as the group leader. In a gamified online discussion environment, one engagement environment has been developed, which is used for creating a group topic, posting, reading, updating, replaying, and discussing your group topic. After the students created their topics and discuss this topic with their peers, the students should create and upload their first presentation progress report. Then, they should apply for the second online engagement environment for more discussions, updates and posts on their topic and those of their peers. In general, each day, the student should make at least two posts in the engagement environment. After completing all mentioned progress, one module was created for students to upload their final project on the online environment.

First, the pre-test and post-test questionnaires are designed to assess the learning management system – Moodle.
The students’ replies to the questionnaires were collected and exported to be used as indicators to measure and visualize the online student engagement in the gamified online discussion environment. Second, the GISMO block plugin (Statistical Analytics) was used to address students’ engagement.

With the GISMO tool, instructors have ability to inspect the different features of distance students such as students’ attendance and the (log data) numbers of times accessing the course activities, creating, posting, updating, reading, discussing and submitting course assignments and activities. The data are then exported from the learning management system - Moodle - through the online environment.

VII. DATA ANALYSIS AND RESULTS

In this study, the IBM SPSS software is used to analyze the pre-test and post-test questionnaire data. Furthermore, descriptive statistics are used to analyze the frequencies and determine the means of the pre-test and post-test questionnaires. Analyze -> Compare Means (paired sample t-test) is utilized to assess the significant differences between the pre-test and post-test questionnaires. GISMO’s statistical analytics plugin is used to extract and explore students’ online behaviors, with providing graphical representations of student interactions.

A. ANALYTICS RESULT

Figure 10 shows the participants’ (log data) Moodle access data. In total, 45 students used the online environment through the 8 weeks from the 1st of April 2018 – the 26th of May 2018. The red dots represent the number of times participants accessed the system in the represented week. The total numbers that are shown below represent how many times the students logged in gamified discussion environment.

Figure 11 demonstrates the discussion environment’s access trends. The letters from ‘A’ to ‘H’ describes the activities of the log-ins based on the responses to the activity. In the beginning, the project was announced and the instructions and login details were provided to students during lecture hours. At point ‘A,’ there are 27 log-ins in the first week and this illustrates that between the first and the second week, students try to understand the system and answer the pre-test questionnaire. At point ‘B’, which is week 2, with 65 logs, the participants accessed the term project specifications to understand the requirements. Meanwhile, constituting their project group results in a decline in the logs at point ‘C’ with 44 log-ins. During the third week, students needed to meet with the lecturer to approve the group members. In the fourth week, there was an increase in log-ins to 69 at point ‘D’, since students needed to choose a topic, share, and make decisions with their peers in the online engagement environment. After a short discussion and determination of the topic, there was no increase or decline in the log-ins in week five at point ‘E.’ This shows that students engaged online to discuss with other participants from other groups and to discuss with their group members to prepare for the first presentation. At weeks 4 and 5, the logs were at an equilibrium. This is the result of students meeting together offline and/or online to simultaneously to prepare their presentation. After completing the first presentation and in preparation of the second presentation at point ‘F’ in week 6, there was an increase in log-ins from 69 to 72 while participants engaged online to share and discuss their second presentations. Week 7 at point G is when students met offline to prepare their final submissions. There was an increase in accessing the referential guidelines and there was a deadline for the project’s submission, and the log-ins were recorded as high, as stated in week eight at point ‘H.’ Just logging into activities does not determine that participants were engaged, but logging into the resources that are available within the online engagement environment could provide reasons to determine that participants were engaged with the online resources. The section below explains the access to the resources that were used to determine the students’ engagement.

Figure 12 shows the total numbers of student accesses to resources in the 8 weeks. The students should have reviewed the content of the resources and understand them well enough before becoming involved in the online engagement.
As illustrated below, the fewest number of resources that were accessed by the students is only one access per resource, while the highest number of accesses by the students is seven times per resource. The total number of students who accessed the resources has shown that the students effectively interact with the resources. The project specification video is the most accessed resource since the students want to understand the project specifications well to meet the requirements. The second most accessed resource is the Harvard referencing guideline file since the students need to understand and carefully follow the required referencing style. The third most accessed resource is the suggested research area because students are striving to select an interesting topic for their project. The students access the MIS quarterly journal and the lists of ACM conferences and information and management journal resources because they might be uninteresting and not widely used by the students. The basics of paper writing and publishing URLs are the least accessed resource because students’ priority is not to publish a paper but to complete the project on time.

Figure 13 shows that 45 participants submitted the first presentation, the second presentation, and a final project. Here, a submitted assignment is presented as an empty red box on the bar. In general, according to the assignment submission overview, the students are highly engaged in the gamified online discussion environment because the majority of the participants completed and submitted their projects.

Figure 14 demonstrates the participants’ access to the engagement environment in a gamified online discussion environment. The numbers below a preset number of times show that students are participating in engagement activities such as writing, updating, posting, and discussing with their peers in the gamified environment. The contribution to forums overview is illustrated in two different colors, red and gray. Red represents the participants who are writing, updating, and posting in the engagement environment. In this study, the maximum number of posts and updates is 26, while the minimum number of posts and updates is 3.

Gray illustrates the participants who are reading and following their own and peers’ posts (topic). The maximum number of read posts by the participants is 182, while the minimum number of read posts is 17. The researcher was monitoring the engagement environment and all topics that were discussed that were related to the course and project content. As a result, the number of posts and reads of participants reflected that the online student engagement improved and there was increased student interaction with their peers.

Figure 15 shows the students who have engaged with the gamified online environment, their levels, the total experience points that they earned, and their learning activity progress. In the gamified environment, the leaderboard has a powerful impact on student interaction and supports the recognition of the students with top academic achievements [46]. In this study, the result has shown that students highly participate in the gamified online discussion environment because they were motivated to gain experience points to pass to the next level. Furthermore, competition is promoted with using a
leaderboard because it supports the potential enhancement of students’ engagement levels.

Figure 15 illustrates that the students are highly motivated and contributed to the gamified online environment. According to the level up ladder, 38 students were placed in level 9 because they collected and earned all relevant XPs from the resources, assignments, and discussion environment. The implementation of gamification in an online environment aimed to improve students’ participation using the XPs, which encouraged the students to collect more points and be labeled as top achievers.

**B. T-TEST**

Based on the compared mean statistics, we applied the paired sample t-test to the post-test and pre-test questionnaires to illustrate the significant differences between the post-test and pre-test questionnaires. In the table below, the t-test results show that there is an impressive improvement in the students’ engagement since the mean is 4.5146 for the post-test, which is higher than the mean (3.8390) for the pre-test. Additionally, the standard deviation for the post-test is 0.21250, while that for the pre-test is 0.54858.

According to the paired sample test, as shown in table 5.2, there are significant differences between the pre-test and post-test since \( t(40) = 7.997 \) and \( p = 0.000 < 0.05 \).

However, using the t-test, the significance value is 0.149 for the post-test and it is 0.000 for the pre-test. This shows that there is a significant difference between the post-test and the pre-test because 0.149 is more significant than 0.000. There is a 95% difference between the 0.84636 and 0.50486.

We used the descriptive statistics to calculate the skewness and kurtosis for the 20 questions of the pre-test and post-test questionnaires. The skewness and kurtosis should be between \(-2.3\) and \(+2.3\) to ensure the normality of the data [47]. Furthermore, the acceptable range for the skewness and kurtosis is between \(-2\) and \(+2\) to be able to determine the normal distribution of the data [48]. The results show that the data are normally distributed because the skewness and kurtosis for both are in the acceptable ranges.

**VIII. FINDINGS AND DISCUSSIONS**

This study examined and explored the impacts of a gamified discussion environment on student engagement in Moodle. According to the results, the use of gamification in the online discussion environment has a positive impact on student engagement.
Students in traditional online discussion environments are less engaged and less frequently access the course contents [8]. In this study, students’ activity and content access data show that students highly access the course activities and the results suggest a positive influence on student engagement. Based on results that are indicated in Figure 12, the total number of accesses for each student shows that they had good engagement by accessing the online resources in the gamified discussion environment. Gamification has improved student interaction with the resources, which is proven using the minimum and the maximum numbers of resources that are accessed by students.

The results have exposed that the majority of the students participated and submitted their assignments in the gamified online discussion environment, and only a few students had low engagement in the discussion environment. Students’ submission overview shows that classmates’ submissions influenced their engagement and encouraged them to complete their assignments. The use of the gamification environment influences students’ engagement and supports their learning processes [51].

Leveling up, leaderboards and progress bars play critical roles in improving student engagement in a gamified discussion environment, which provides a structured set of objectives for performing tasks and gaining rewards to complete their activities and increase student engagement [11], [52].

As illustrated in Figure 14, the high numbers of posts, updates, and reads prove that students are positively engaged. Concerning behavioral engagement, the access of the course site by the student is done to keep following their task achievements, check their received responses, make more posts and reread peers’ discussions to gain more points and pass to the next level [14].

IX. CONCLUSIONS, LIMITATIONS AND FUTURE WORK

Adopting gamification in an online environment improves students’ reactions and enjoyment [49]. In this study, students reported that the gamified online discussion environment was enjoyable and exciting compared to traditional online discussion environments.

Using game mechanics and game elements in a gamified online discussion environment has a high impact on students’ achievements since participants are interested in logging into the course, monitoring their responses, posting, rereading and discussing with their peers to improve their levels on the leaderboard. The leaderboard can improve students’ engagement rates in the gamified online environment, which provides a structured set of objectives for performing tasks and gaining rewards to complete their activities and increase student engagement [11], [52].

The future conceptual framework can determine which game element has the most impact on students’ engagement to improve their learning achievements.

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