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Effectiveness of gamification in teaching and learning mathematics

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Abstract

Recent years have seen the development of a new culture in the teaching and learning process, such as the implementation of gamification. The application of gamification aims to enhance the teaching and learning process as well as the experience and satisfaction of those who participated. Recently, much ongoing research have been focusing on improving the quality of the teaching and learning process. The implementation of gamification activities in teaching and learning shows its ability to increase participants' experiences, responses, and engagements to the educational sessions. Therefore, increasing numbers of research are performed to explore the suitable types and approaches of gamification that can be used in education. On the other hand, while improving the quality of the education's environment is a key factor, it is also important to explore the satisfaction and motivation of all learners in this new adaptation to the education environment. The objective of this paper is to investigate the factors influencing students' scores via the implementation of the gamification elements in their Mathematics classes. Their expectations, experiences, motivations, as well as satisfaction in Mathematics classes were analysed via multiple linear regression analysis to study the learners' perspective towards the implementation of gamification in education. The results show a significant relationship between all factors with the student's assessment score. The increment in students' motivation to study and participate in class activities contribute to their performance in the subject taught. The regression model showing the relationship between students' motivation in class and their final assessment marks has been presented. The present result might contribute to the better teaching and learning environment option. Our youngsters nowadays need a new treatment in teaching and learning delivery. Hence, it is highly recommended to implement gamification activities in teaching and learning lessons. This study validates that gamification is also effective in Higher Education to promote better learning in challenging subjects.

Keywords: Gamification, Innovation in Education, Mathematics Education

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Mathematics is known as the prime vehicle for developing student's logical thinking and cognitive skills. This subject plays a major role in other scientific fields such as engineering, physics, statistics, and etc (Ganal & Guiab, 2014). Unfortunately, the subject has been said to be difficult and of little interest to certain people especially students. Moreover, mathematics anxiety that developed among students is the result of their negative attitude and embarrassing experience with mathematics in previous years. This situation usually happens among undergraduate students who already have experience learning mathematics in their former school. Students who undergo such experience will believe that they are

deficient in mathematics, which then results in poor performance in mathematics during their undergraduate level. Teachers should work on the basis that students could design their learning process without giving rise to negative experiences due to poor learning design and planning (López-Belmonte, Parra-González et al., 2020). In this situation, the teachers' knowledge of the subject matter and their ability to deliver the subject are very important factors in teaching and learning mathematics. However, the central factor that must be included is the teaching and learning styles and methodologies (Xi & Hamari, 2019).

The methodology in teaching and learning mathematics has been an interesting subject to be discussed among researchers. The number of publications involving traditional and modern teaching techniques has increased over time. Students' attitudes, expectations, and emotions play an important role in their mathematics performance (Tran & Nguyen, 2021). It has been mentioned that students' lack of motivation to study is an important topic that needs urgent attention (Rozhenko, 2021). Major challenges in education nowadays are adapting to today's learners' new attitudes and demands. As they have grown up in a digital world full of technologies, they have different needs and preferences towards their learning activities. Previous studies have shown that most educators had performed limited strategies to support students' engagement and performance in learning mathematics (Chin & Fu, 2021). Motivated by the modern pedagogical approaches and techniques in education, one needs to establish new methods to encourage learners to be highly motivated in participating and engaging in their learning sessions.

In the past few years, many educators have started to be aware of the potential of educational games to reinforce knowledge and problem solving, communication, and collaborating skills among learners. Integrating a non-digital game-based learning approach into a mathematics lesson can positively affect the student's performance (Mohd. Yusof & Shahrill, 2021). It seems to be a promising approach to cater for major problems faced by educational institutions nowadays on learners' participation and engagement in their learning environment (Lee & Hammer, 2011). The word 'Gamification' can be clearly defined as the process of applying the game mechanisms in non-gaming environments. The use of gamification elements and designs can also be considered in an educational context (Manzano-León et al., 2021). To encourage students' participation in-class activities, the traditional teaching method can be associated with the game designs, which then proposed a dynamic education environment and experience. According to Mora et al. (2017), gamification applications often lack a formal design process. They do not always follow a theoretical framework, where the role of the gaming elements within the gamified application does not always have the desired effect, it is intended for (Manzano-León et al., 2021).

Previous scientific studies have shown that students find the use of the games led to better communication with their classmates and teachers, which also motivated them to capture the course (García-Hernández & González-Ramírez, 2021). In improving the learning environment, one important positive aspect is the idea of uniting the students and educators in the adaptation of role-playing. During the students' sociological survey, it was found out that the quality of students' adoption of educational material would be improved through gamification. In addition, their level of stress while waiting for the evaluation of their knowledge and skills also can be reduced by the implementation of gamification in learning activities (Kirillov et al., 2016). It has been mentioned in literature, where a study has proved that there is an increased release of chemicals known as norepinephrine, epinephrine and dopamine in the brain as a result of gamification activities (Brull & Finlayson, 2016). It is not only bringing on a good feeling but it also makes learners more receptive to learning.

In previous studies, even though there are growing applications and studies focus on applying gamification in teaching and learning mathematics among undergraduates, many issues are left unresolved, for example the effectiveness of gamification is still unclear. Besides, it is difficult to decipher the gamification elements or combination with the most impact. Thus, this study aims to investigate the effectiveness of gamification activities in teaching and learning mathematics among undergraduate students by considering a few key elements of gamifications. The game designs have been constructed to be implemented in teaching mathematics, focusing on students' participation and feedback.

Gamification Model in Teaching and Learning Mathematics

Deterding et al. (2011) defined gamification as an element that uses game-based mechanics and thinking to engage with people, motivate them to act, promote the learning environments, and solve the related problems. Implementation of games influences frequently targeted feedback from learners. Feedback is one of the important key elements in education (Kapp, 2012a). The effectiveness of the learning process can be measured from learners' feedback since more frequent and more targeted feedback pictured the effectiveness of the education sessions to the learners. The design of gamification elements applied in the learning process ensures that learners engage and participate in their learning sessions to provide feedback moment by moment. In the end, it requires them to practically implement all knowledge and skills they learned throughout the learning process (Kapp, 2012b).

A few game elements have been introduced by Gonçalves et al. (2013) in the Information Systems and Computer Engineering course, which are experience points, badges, challenges, levels, and leaderboards. It has been reported that the gamification activities implemented led to the exceptionally good engagement and participation of students online courses. Even though it shows no improvements in student grades, the gamified learning environments positively influenced lecture attendance. A survey has been performed to study the effectiveness of new teaching methods to the students (Berkling & Thomas, 2013). All students have been exposed to the gamification elements such as points, levels, leaderboards, and immediate feedback in the study Software Engineering course. The results suggest that students did not find it helpful and were generally not interested in such a gamified environment. It has been concluded that, for students who are already familiar with the classical teaching methods, it is not easy for them to get enticed to the new teaching environment in which gamification has been implemented (Berkling & Thomas, 2013). A few studies on gamification in teaching can also be found in the literature (Betts et al., 2013; Brewer et al., 2013; de Freitas & de Freitas, 2013; Athanasia Eleftheria et al., 2013; Gibson et al., 2015; Goehle, 2013).

Game designs are important tools used in implementing the gamified learning process. A few gamification designs have been introduced, such as experience points, levels or stages, badges, leaderboards, prizes and rewards, progress bars, storyline, and feedback (Fui-Hoon Nah et al., 2014). Point system is used as a reward that measures the participant's achievements. It also can be used to indicate where the participants stand. O'Donovan et al. (2013) mentioned that the definition of points varies according to the game implemented. For example, the Experience Points are the points given for each task completed, while the Steam Points are the points that correspond to the game's currency. In an academic environment, Kumar & Kumar (2012) consider points as a credit given to all learners. Levels or stages system is a popular gamification element used in various game designs. It provides participants with their progression in the game played. Generally, the game requires less effort than the advanced levels at initial levels, where more knowledge and skills are acquired. However, this scenario will sometimes result in no progression in the students' learning abilities (Goehle, 2013).

This new environment in the teaching and learning process will somehow affect the learners' motivation in class. After years of learning through the classical teaching method, it is quite difficult to switch to the new norm of teaching environment that integrates the gamification techniques. Consequently, it is also necessary to maintain the learner's motivation throughout the learning process (O'Donovan et al., 2013). Badges are the game design elements that work as an appreciation mark for every task completed. It will help every learner to consistently check on their progress and keep them engaged in the class activities, indirectly motivating them to achieve their goals. In addition, for the same purpose, which is to keep the learners motivated, leaderboards are used to display the current high scores, usually the five highest scores. All learners will keep up-to-date about their position as well as their achievements, where this situation creates a sense of eagerness among learners to win the game. In Raymer (2011), the author mentioned that leaderboards are the gamification element with the highest ranking in keeping learners motivated.

In addition, prizes and rewards are proven to be effective to boost learners' motivation. As mentioned by Kim & Werbach (2016), variety in reward's scale and timing affected the motivation of learners. Besides, progress bars, storyline, and feedback are other game elements used in the new environment of the learning process that involves gamification, as mentioned in literature (O'Donovan et al., 2013; Raymer, 2011). In contrast with the badge element that displays the current position in the game played, progress bars demonstrate the overall learner's progression in gamification. Learners can always track their progress by referring to the progress bars. It will indirectly encourage all learners to boost their effort and win the game. Here, the storyline is about the whole story in the game. This element specifically provides pictures of the problem-based situation, giving the idea of its implementation in real life. It guarantees the learner's interest and motivation towards the learning process (Berkling & Thomas, 2013). In Goehle (2013), the author suggests that feedback is an important element for ensuring learner engagement. Immediate and frequent feedback confirms the effectiveness of the learning process as well as picture how learners get to engage in the activities.

As mentioned by Lee and Hammer (2011), the use of game mechanics to promote desired behaviours among students is one of the most important key elements that defined gamification. It is an important matter to explore the combination of key elements that promise effective gamification activities among students. In this research, a few common elements such as points, badges, challenges, level, and leaderboards will be combined and implemented in gamification activities. Figure 1 presents the model of gamification activities used in this study.

Therefore, in this study the gamification elements which are feedbacks, points, badges, levels, and leaderboards will be combined and used in designing gamification activities for students. Students' expectations and experience in a gamified learning environment will be examined; hence their motivation and satisfaction will be measured. This will advise the combination of successive key elements for gamification and present the effectiveness of gamification activities in teaching and learning mathematics.

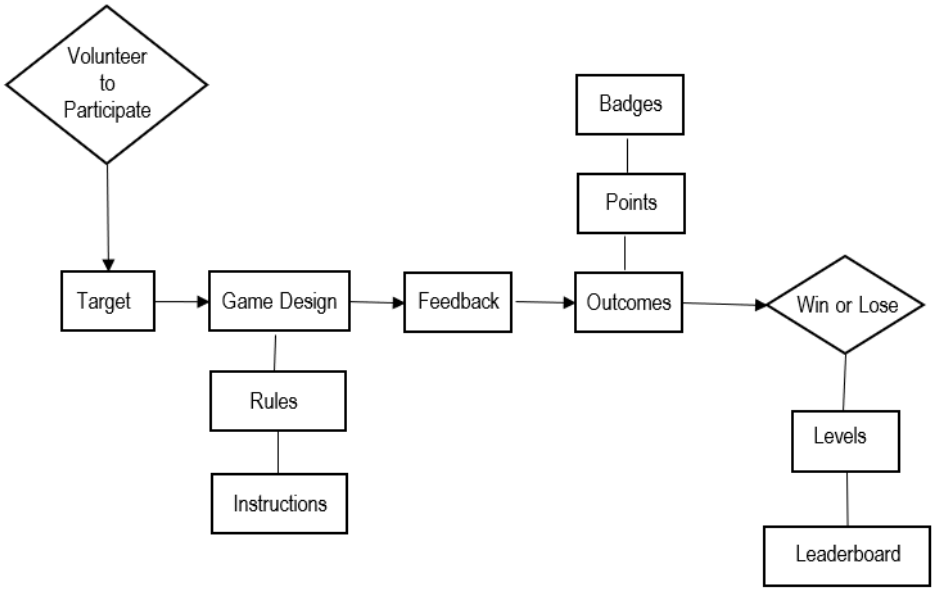

Figure 1. Gamification model

METHODS

This study is designed as experimental research using quantitative research methodology. The experimental groups were systematically selected from the whole population groups. In experimental groups, the learning process with the implementation of gamification activities was carried out. The research methodology allows the investigation of the effectiveness of the gamified learning process and students' perspectives towards the new environment of teaching practices.

Participants

This study's participants are semester four diploma students from the Faculty of Applied Sciences at one of the higher institutions in the east-cost of Malaysia from March-August 2021. This study was conducted during the Statistics & Probability lesson, where 111 students were enrolled. Of those 111 students involved, 44 were males, while 67 were females. All students attend the same 56 hours of class via the same online platforms: Google Classroom, Microsoft Teams, Telegram, and YouTube.

Gamification Implementation

The study was conducted during 14 weeks of lesson period for the Mac-August 2021 semester. The game was designed to have four elements: feedbacks, badges, points, and leaderboards. Every student was rewarded with different badges for completing every task given. Each badge represents the number of points earned and students' achievement was updated, where the cumulative points were displayed on the leaderboard. Figure 2 presents the badge used in the gamification activities and the leaderboard to represent their progress.

Figure 2. Gamifications badges (left) and leaderboard (right)

All achievements were recorded in Figure 3, where every progress was updated on the leaderboard. In addition, students can see their current position displayed on the leaderboard, which can help them plan their strategies to compete and eventually win the game.

Bil	Student	Achievement
1	AINUR ALYSA BINTI SHA'ARI	
2	MOHAMAD HAKIMI BIN ZAMRAY	
3	MUHAMMAD FITRI HAIKAL BIN NAZRI	
4	MUHAMMAD HAZIQ BIN RUZLAN	
5	NADIATUL FATHIAH BINTI SUDIN	

Figure 3. Sample list of achievement

Students were briefed about the gamification activities implemented in the Statistics & Probability course, as shown in Figure 4. After objectives of the new learning environment have been determined, the gamification activities have been integrated by considering the use of components, dynamics, and mechanics (Kamasheva et al., 2015). The narration techniques were used at the beginning of the semester, where the students were exposed to the concept of gamification in the teaching and learning environment. Students will be briefed with the flow of the gamification activities throughout 14 weeks of semester. Then all gamifications' elements will be introduced. Teaching and learning session will be run by implementing gamification activities in each class sessions. Students' responses and feedbacks will be observed during the teaching and learning sessions. At the end of the semester, students' will be given a set of questionnaires to be answered related to their experience, expectation, satisfaction and motivation after went through the learning process with the implementation of gamification activities. Their questionnaire score, final assessments' score as well as their participation in class will be analyzed to see whether there is any relationship between gamification implementation in learning environment with

students' motivation.

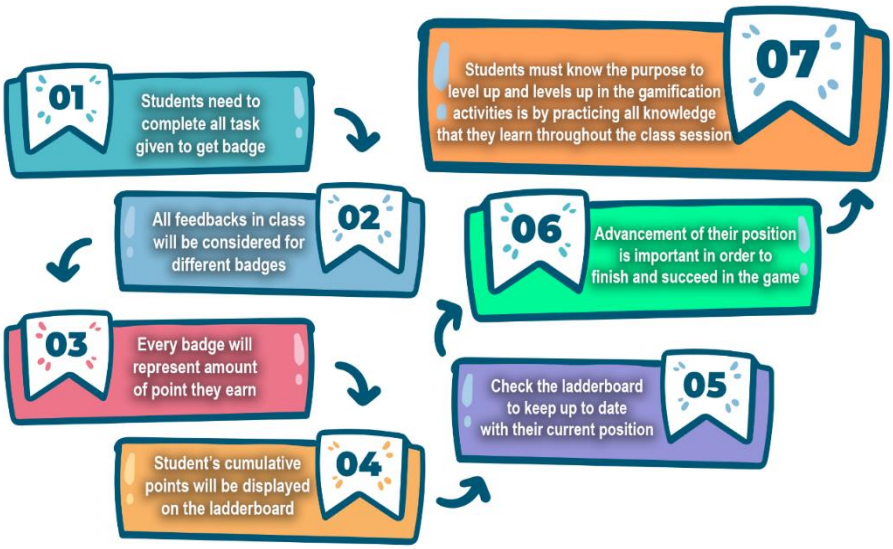

Figure 4. Infographic of games' instructions

Data Collection and Analysis

Every student underwent four main assessments throughout the semester for the STA108 course. The assessment developed is to measure students' knowledge of the subject. It also represents the achievement in completing all the course learning outcomes (CLO). At the end of the course, the questionnaire was distributed to determine the effects of gamification on students' motivation and satisfaction towards the teaching and learning process with the implementation of gamification. All the students were provided with a questionnaire consisting of 32 items to measure their attitudes towards the gamified learning environment. The questions from the questionnaire for measuring students' expectation, satisfaction, experience, and motivation through a gamified learning environment can be seen in Table 1.

Table 1. Formatting rules

Question Group	Questionnaire
Expectation	1. Gamification can foster motivation in education / teaching and learning. 2. Gamification can reduce the boredom in education / teaching and learning. 3. Students engaged in educational gamification are more motivated to participate in class compared to those who are not involve in the game. 4. Students engaged in educational gamification can improve their academic performance. 5. Gamification can make the learning process exciting and informative. 6. Gamification can enhance the learner's experience by facilitating better understanding in their course. 7. The rewards for the achievement in class motivate the learners. 8. Gamification in learning improves learner engagement.
Experience	9. Gamification in teaching and learning makes a learner feel that they need to complete all tasks given. 10. Gamification pushes a learner to strive for better accomplishment. 11. Learners become more progressive and better in the course that involves

	gamification. 12. Gamification makes a learner feel like they need to continuously improve themselves in the learning process. 13. Gamification can measure learner's abilities and give them encouragement to perform well in their courses. 14. Gamification can inspire learner to compete and win the competition. 15. Gamification makes a learner feel the excitement of being involved in class activities. 16. Gamification provides learner with overall playful experiences in learning activities.
Satisfaction	17. I enjoy my learning sessions involving gamification activities. 18. I feel excited to participate in the gamification learning activities in every class session. 19. I feel satisfied when I am able to compete healthily in gamification activities with my classmates. 20. I found that gamification learning activities make learning sessions become more effective. 21. I am satisfied with the games and rewards offered in gamification activities. 22. I will recommend learning session involving gamification to be implemented in other courses. 23. Based on my experience, learning through gamification is one of the most practical learning methods to be applied in class. 24. I am happy with my assessment result in the course that involved gamification activities.
Motivation	25. The implementation of gamification makes me improve my understanding about the course from time to time. 26. Even if I don't win the game, I never stop trying to do better next time. 27. I feel motivated not to miss any class so that I can be involved in gamification activities. 28. I am willing to participate in other gamified courses again. 29. The gamification activities motivate me to think creatively in solving problems. 30. The gamification activities motivate me to prepare myself on discovering new and unpredictable things. 31. I feel determined to earn more points in the gamification activities. 32. The gamified activities motivate me to score higher for the subject.

The data analysis was done using SPSS 26 software, where the flow of data analysis is presented in Figure 5.

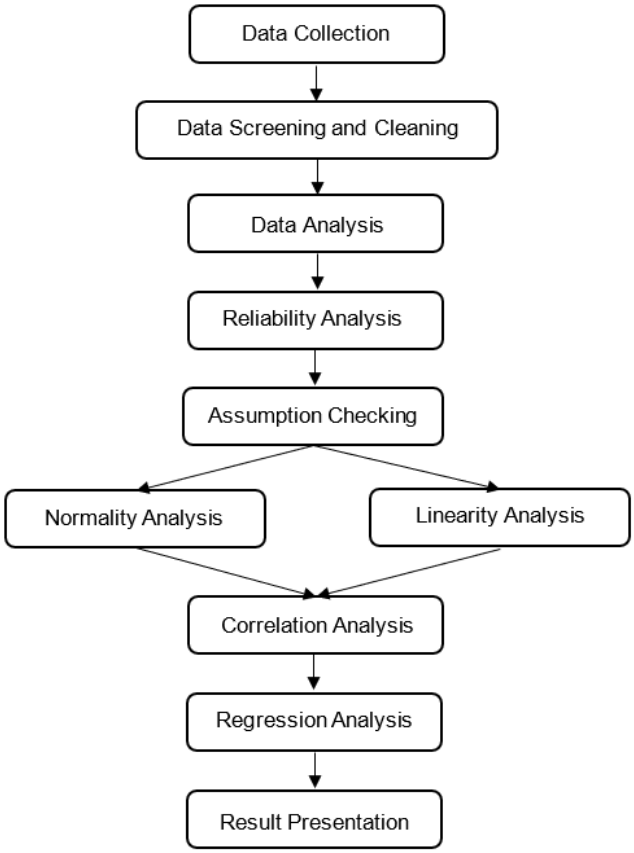

Figure 5. The flow of data analysis

RESULT AND DISCUSSION

A questionnaire consisting of 32 items with eight items each checking on students' expectations, experience, satisfaction, and motivation has been collected and analysed. The data analysis started with the reliability test. This analysis measures the consistency of the scale to reflect all constructs measured. All values of Cronbach's Alpha measuring the internal consistency are presented in Table 2.

Table 2. Reliability analysis

Construct	Cronbach's Alpha
Expectation	0.941
Experience	0.968
Satisfaction	0.919
Motivation	0.947
Overall	0.984

All constructs were found to have acceptable and satisfactory reliability since the value of Cronbach's Alpha is greater than 0.5. In addition, the value of overall Cronbach's Alpha is 0.984, which indicates that the scale has an excellent internal consistency to represent all constructs measured. In this study, all students' assessment marks were set as a dependent variable, where the distribution of all

marks is presented in Figure 6.

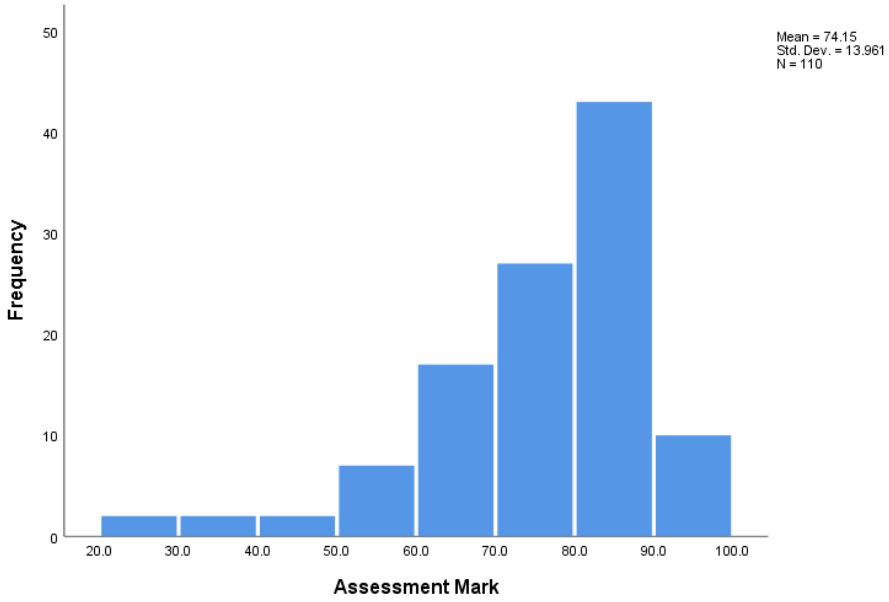

Figure 6. Assessment mark distribution

This distribution is said to be positively skewed, consistent with the average score distribution for all constructs, as presented in Figure 7.

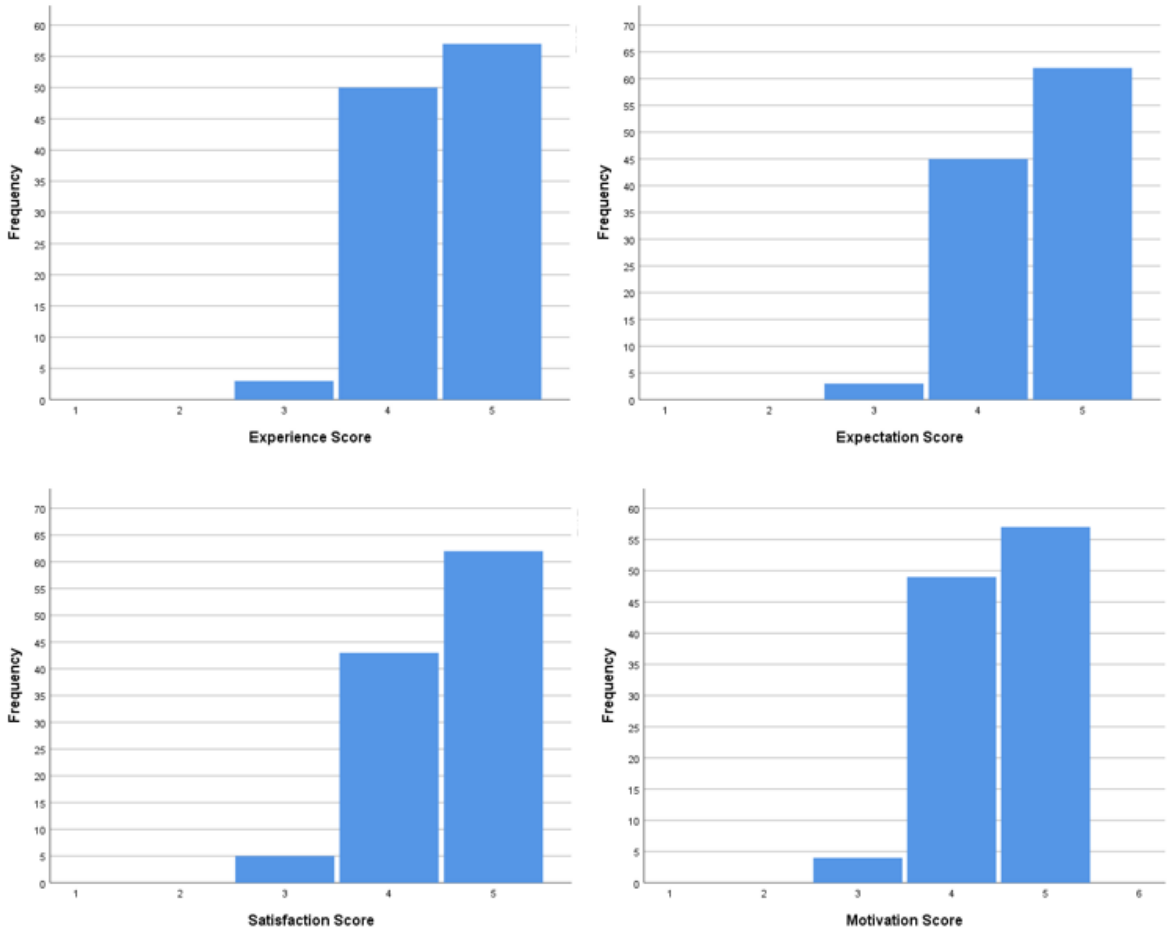

Figure 7. Average score distribution for each construct

Multiple linear regression analysis assumes that there exists a linear relationship where the residuals are normally distributed. Therefore, we perform the assumption test by plotting the scatterplot and a P-P plot to check the linearity and normality of the residuals, as presented in Figure 8.

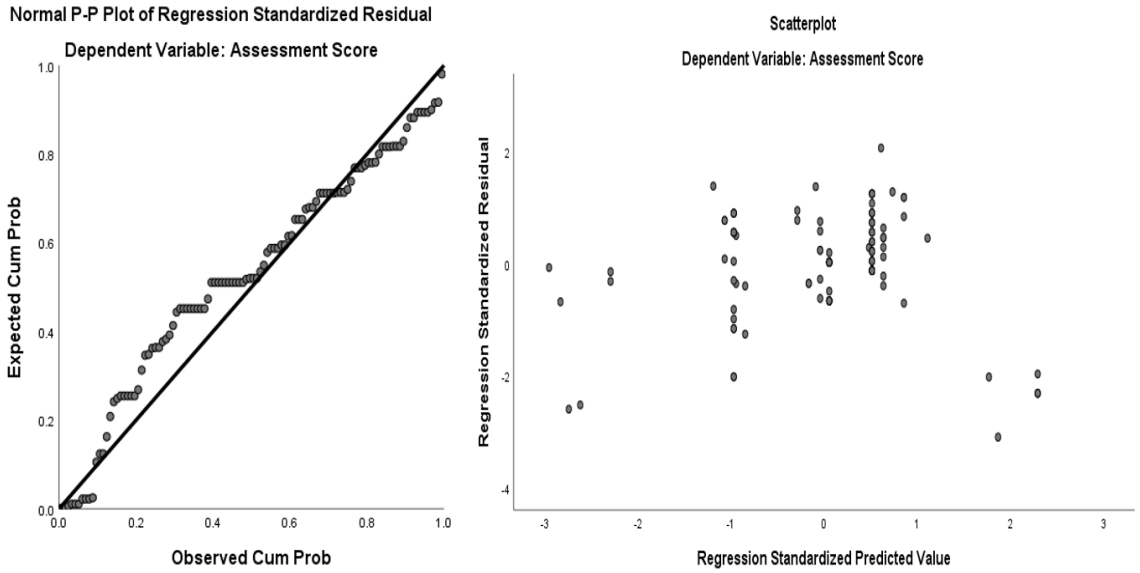

Figure 8. Normal P-P plot of regression residual (left) and residual scatter plot (right)

The random pattern on the scatter plot suggests a linear relationship between the residuals of the regression. It can also be supported by the fact that there are no outliers that can be seen in the scatter plot as no data fall outside the range of -3 and 3. This linear relationship ensures that any influential observations are not involved in the data that may affect the result of the regression. Normality distribution test on the P-P plot shows that all points approximately fall along the straight line, implying that all residual errors were normally distributed, and all assumptions are not violated. Furthermore, the word correlation is usually used to picture some association. In this study, correlation analysis has been performed to determine the association (if any) between two quantitative variables. Table 3 presents the Pearson's correlation coefficient and the p-value of all constructs.

Table 3. Correlation analysis

Dependent Variable	Independent Variable	Pearson's Correlation Coefficient, R	*p*-value
Assessment Score	Expectation	0.922	0.000
	Experience	0.798	0.000
	Satisfaction	0.824	0.000
	Motivation	0.846	0.000

Table 3 shows a significant relationship between all factors (expectation, experience, satisfaction, and motivation) with the student's assessment score since the p-value of all factors is less than 0.05. Furthermore, the correlation coefficients 0.922, 0.824, and 0.846 indicate a strong positive correlation between expectation, satisfaction, and motivation factors, respectively. In a previous study, gamification is said to be authentic since its start from fantasy that provides a compelling background allowing students to experiment with their skills without thinking of all consequences of failure that they may face (Najjar &

Salhab, 2022). This is how expectation contribute to their performance in gamification activities which then affect their satisfaction and motivation in learning mathematics. Meanwhile, the correlation coefficient of 0.798 suggests a moderate positive correlation between the experience factor and students' assessment scores. Therefore, it advocates that increasing value scores in any factor will result in the increase of the student's assessment marks. The integration of gamification elements into learning activities will engage learners physically, cognitively, and socially. It shows that gamification is proven to enhance cognitive, emotional, social learning, and cooperative learning skills which then helps learners to improve their interest towards mathematics and encourages them to learn better. In addition, two factors have been shown to fulfil the multicollinearity assumption, which is expectation and motivation, as presented in Table 4.

Table 4. Collinearity analysis

Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Expectation	0.255	6.452
Motivation	0.255	6.452

The tolerance values that are more than 0.1 and the VIF values less than 10 support the multicollinearity assumption that was not violated. The data analysis continued with the regression analysis, where the results are presented in Table 5.

Table 5. Regression analysis

	Coefficients	Std. Error	Beta	t	*p*-value
(Constant)	23.813	4.008		-5.941	0.000
Expectation	-.195	2.354	-0.008	9.783	0.934
Motivation	24.948	2.550	0.929	-0.083	0.000

It is not significant to include the expectation factor in the regression model as its p-value is greater than 0.05. On the other hand, the motivation factor was found to be statistically significant with a p-value of 0.000. Table 5 shows a positive relationship between students' motivations with their assessment scores. Therefore, the regression model can be written as presented in Equation 1.

$$Assessment\ Score = 23.813 + 24.948\, motivation \quad (1)$$

The increasing motivation score results in students' assessment scores increment. It proves that the gamification approach has potential as an alternative educational tool for the improvement of motivation, participation, and their scores as mentioned in literature (Sánchez et al., 2020). Motivation plays an important role in engaging students to study and perform in Mathematics (Ofosu-Ampong, 2020; Smiderle et al., 2020). Gamification learning has the potential to be a very powerful environment for teaching and learning (Lapuh Bele et al., 2016). It has been mentioned that making a game is a rich task, indirectly motivating students to exercise a wide spectrum of skills and eventually helping them score in

their assessments (Deterding, 2012).

This technique is one of the dynamics elements in designed courses (Robertson & Howells, 2008). All students are aware that the course they learn involves gamification activities. Getting involved in these activities would allow them to gain points and win a reward at the end of the semester. This technique will indirectly encourage students to participate, respond, and engage with class activities. Chances, competitions, cooperation, and challenges are all elements of dynamics (Robertson & Howells, 2008). Chances are created by designing the gamification activities involving all students. As students are able to score and get points for every task given, they will keep on tracking their progress on the leaderboard provided. This scenario will ensure the students willingly make progress once they are aware of their friend's position where the competition and challenges exist. The cooperation mechanism was put into practice by rewarding them for their group assessment and teamwork spirit in assisting their friends in class. As mentioned before, the components used in designing games are feedbacks, badges, points, and leaderboards. When students get engaged with class activities, they will be rewarded with badges. In addition, completing all tasks given and participating in any activities during class are the other sources for them to get rewarded. Badges will be given according to their feedback and correct answers. It is used to demonstrate the points given, and cumulative points for every student will be displayed on the leaderboards where all students can track their current position in gamification activities. Finally, when they reach the finishing point as on the leaderboard, the game is complete, marking the end of the course taken.

This study has shown that the gamified learning environment is one of the methodologies of teaching and learning that has great impact on the learning process. It has been mentioned in literature that pedagogical methodologies that incorporate technological resources in education aim to streamline educational contexts and promote student motivation through the work of digital competence (López-Belmonte, Segura-Robles et al., 2020). Hence, the implementation of gamification would allow students to take the leading role in their own playful environment of learning which then contributes to a competitive learning environment with high levels of motivation. In the area of mathematics, gamification seems to be beneficial in its application since it increases competitiveness for learning, motivation, and student interest (Fuentes-Cabrera et al., 2020).

In higher education, gamification activities focused on utilising students' main expectation, promoting their participation in the learning process, encouraging achievements and their significant results. One of the factors that explained such efficiency is immediate feedback. Feedback is one of the key elements in game design studied. Their immediate feedback will be rewarded in points and every passing level will allow all learners to immediately get an analysis of their performances. This situation responds to the target actions of the learners which will give them room for maneuvers. This is how a learner consciously approaches the learning strategy (Sadovets et al., 2022). Gamification activities have shown to promote a few basic principles. The first one is that all learners will learn through doing. While completing the task, students will gain knowledge, and this also helps in delivering the course learning outcomes. In addition, all learners will learn to learn where through gamification activities, students usually get used to analysing their own experience and process a new knowledge from it. Besides, the gamification in mathematics education will encourage them to learn to interact since this new methodology requires both cooperation and teamwork. The support that gamification activities were associated with problem-solving skills such as spatial thinking, the powers of deduction, and evidence based decision-making which will expose learners to the new environment of learning mathematics and at the same time boost up their motivation and help them to get a better score in the subject (Miller, 2013).

The ability of gamified education methodology in increasing student motivation and participation in the learning process cannot be achieved by traditional educational methods and strategy (Treiblmaier & Putz, 2020).

CONCLUSION

This study examines the effect of gamification in the teaching and learning process, focusing on a few factors: expectation, experience, satisfaction, and motivation. Gamification activities have been implemented in the class, with student involvement throughout 14 weeks of the semester. Students' scores were used as an indicator to be compared with the scale at the end of the semester. The observation shows that most students agree that gamification can foster motivation in their learning environment. They found that the gamified learning environment reduces boredom in the learning process since this new environment makes it exciting and informative, motivating them to participate in the class activities. Based on students' feedback, the implementation of gamification had encouraged students to improve their understanding of the course learned. It drove them to think creatively and earn a reward for their progress and achievement. Analysis on the scale suggests a significant correlation between students' scores and all constructs examined. This indicates that a gamified learning environment contributes to students' expectations, experience, satisfaction, and motivation, which is consistent with their assessment score.

The student who finds the new teaching and learning environment interesting shows a good and progressive achievement in the course compared to the others who are not interested in being involved in the gamification activities. The correlation analysis done to study the relationship between all constructs and students' final assessment score shows strong positive relationships between the assessment's score with all constructs. Therefore, it suggests that students' expectations, experience, satisfaction, and motivation in the class play a prominent role in boosting their performance in all assessments, contributing to their final score. In the regression analysis, the student's motivation was shown to be a significant factor related to the student's assessment score.

Hence, the regression model has been written to represent the relationship between students' motivation and their assessment score, concluding that increasing students' motivation score will also affect their performance on the subject. Gamification motivates students through the decision-making process that is involved in learning which makes the learning process fun. Their own goals in gamification activities allows them to see the direct impact of their efforts through instant feedback offered. It also teaches the students self-reliance.

A Gamified environment of learning allows students to share experiences and build bonds among learners and educators which help them to gain motivation throughout their learning period. The use of gamification in the educational space of higher education can create a game environment that stimulates the internal motivational process through a situation of choice, steering the student towards exploration and independent action. If the gamification system in higher education environment turns out perfectly, it will promise to provide students an interesting learning experience since along with theoretical knowledge, they also gain emotional experience and practical skills. This will ensure students stay motivated moving from topic to topic which will contribute to the increasing number of students who get better scores and successfully complete the course. Besides, meaningful action results from a personal choice they encounter through the gamification activities will turn the learning process into a vital goal which is a condition for effective learning. The student will not just be alienated in class as it sometimes

happens in the traditional learning method, but in contrast, they become involved in it. This will build students' motivation to resolve tasks given and this motivation which is related to the internal content of discipline will help them to perform well in the course taken.

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Declarations

Author Contribution : NANA: Conceptualization, Writing - Original Draft, Analysis, Editing & Visualization.
NR: Supervision, Writing – Original Draft.
NMFHNBA: Methodology, Analysis & Editing.
YY: Analysis & Editing.
AS: Review & Editing.

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