

INVESTIGATE HOW INCORPORATING GAME-LIKE ELEMENTS IN E-LEARNING PLATFORMS IMPACTS STUDENT ENGAGEMENT, MOTIVATION, AND KNOWLEDGE RETENTION

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Abstract

This study aims to understand how the learning experience of users of e-learning platforms can be enhanced through the incorporation of game-like elements. The research questions and objectives have been set based on the aim of this study. This part analyzes how the gamification approach in e-learning platforms increases the learning experiences of users. Additionally, the interaction process between e-learning apps and learners through the introduction of the gamification process is discussed briefly. The study has collected information regarding the gamified learning process in e-learning platforms through a primary quantitative method. Collecting data through the primary method helps in gathering the views of people regarding the topic, whereas quantitative information provides numeric values that assist in explanation through analysis. Sixty participants were chosen randomly to conduct the survey and collect information, which was analyzed using SPSS software. Users are motivated to learn more quickly and effectively when learning materials have game-like elements that offer rewards upon completion. The learning experience is enhanced, and learners' memory span is increased when they use the game's structured learning approach. It is visible. Through the introduction of levels, points, and badges awarded for completing a specific learning task within the allotted time, gamification highlights the progression process. The use of the quantitative data collection method has immensely helped this study to acknowledge how gamified learning experiences can increase the motivation of users to engage with e-learning platforms. The analysis of the information has helped in linking the relation between findings and existing information effectively.

Keywords: *Gamification, effective learning, increased motivation, rewards, exclusive content*

Introduction

Learning through e-learning platforms has become a regular activity in today's world, as it is easy and convenient. The use of such platforms to gather knowledge can be enjoyable when platform developers positively incorporate game-like elements for a fun-learning experience of learners on the platform (Kashive & Mohite, 2023). It has been observed that the use of game-like elements in e-learning platforms can help users increase their engagement with learning content to gain rewards or virtual currencies. This can boost the learning mindset and increase the memory span and interest of learners in educational content effectively (Saleem et al., 2022).

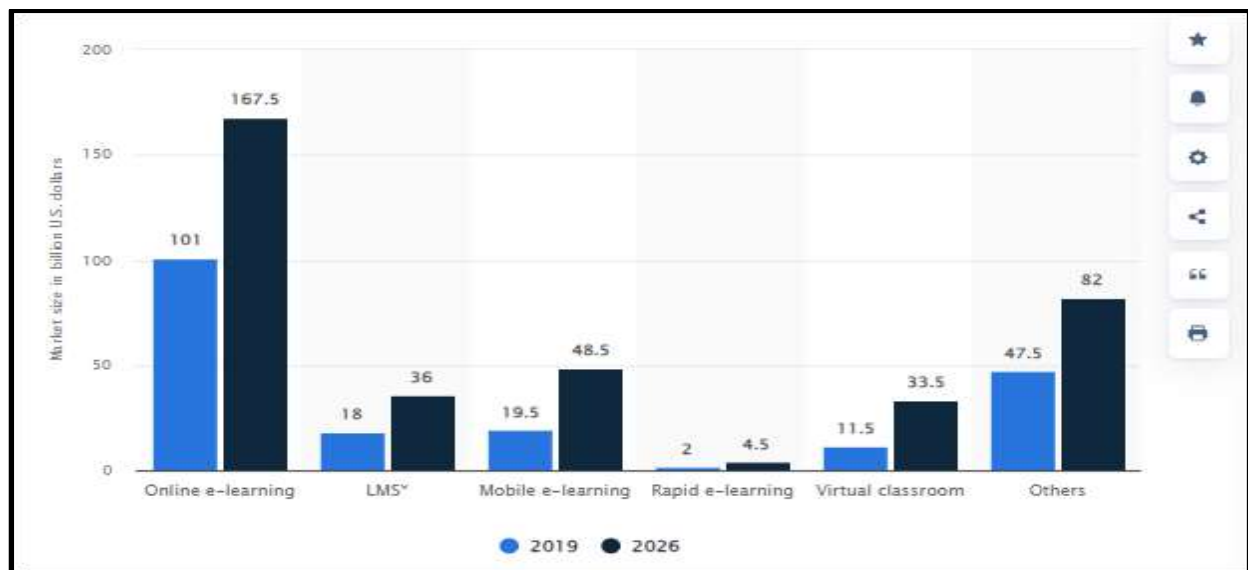


Figure 1: E-learning market globally in 2019 while forecasting for 2026

(Source: Statista, 2022)

Figure 1 illustrates the e-learning market share worldwide in 2019 and forecasts the market share for 2026. It is projected that the e-learning market could grow to \$600 million (Statista, 2022). In 2019, the market share stood at \$200 million in the e-learning sector.

The application of gamified learning experiences can enhance the concentration of learners, enabling them to understand subjects in a better manner. This enhances their visual capabilities and cognitive skills, especially for young learners (Hassan et al., 2021). Moreover, the increasing competition in the educational field can become enjoyable, rather than feeling burdensome, with the integration of gamification into the learning system.

Aim

This study aims to explore how the learning experience of users on e-learning platforms can be enhanced through the incorporation of game-like elements.

Objectives

- **RO1:** To analyze the impact of the gamification approach on e-learning platforms for the betterment of learners.
- **RO2:** To understand the interaction process between e-learning apps and learners through the introduction of the gamification process.
- **RO3:** To discover challenges present in the gamified learning process.
- **RO4:** To recommend ways of improving the gamification approach in e-learning platforms to increase user satisfaction levels.

Research Questions

- **RQ1:** How does the gamification approach in e-learning platforms enhance the learning experiences of users?
- **RQ2:** What are the modes of interaction between e-learning apps and users when incorporating gamified systems in the learning process?
- **RQ3:** What are the challenges observed in the gamified learning process on e-learning platforms?
- **RQ4:** How can the gamification approach in e-learning platforms be improved to enhance user satisfaction levels?

Literature Review

Theoretical Foundation

Motivational Theories and Gamification:

Ryan and Deci (2000) proposed the Self-Determination Theory (SDT), a pivotal psychological framework relevant to gamification in learning. According to SDT, motivation across various human endeavors originates from fulfilling three fundamental needs: autonomy, competence, and relatedness. Gamified learning

environments address these needs by providing learners with choices and control over their learning paths (autonomy), challenges suited to their skill levels with clear feedback (competence), and opportunities for social interaction and collaboration (relatedness) (Ryan & Deci, 2000; Deci & Ryan, 2012).

Cognitive Load Theory and Gamification:

Sweller's Cognitive Load Theory (CLT) offers a perspective on how information is processed and retained in the human mind (Sweller, 1988). Gamified elements can be tailored to minimize extraneous cognitive load while optimizing intrinsic and germane loads, thus enhancing learning efficiency. Gamification aids in managing cognitive resources more effectively by organizing information in engaging and interactive formats, leading to improved understanding and retention of material (Sweller, Ayres, & Kalyuga, 2011).

Flow Theory and Engagement in Gamified Learning:

Csikszentmihalyi's Flow Theory elucidates how gamification enhances learning engagement and outcomes. Flow is a state of complete immersion and focused attention in an activity, marked by a harmonious balance between challenge and skill level. Gamified learning environments strive to induce flow by presenting challenges that match learners' skill levels, thus fostering deep engagement and intrinsic motivation to learn (Snyder & Lopez, 2001).

Analysis of the Ways Gamification Approach in E-Learning Platforms Enhances Learning Experiences

In e-learning platforms, the incorporation of game-like elements effectively captures users' attention, encouraging their active participation in the learning process. This approach significantly increases engagement with the content provided on the learning platforms (Bouchrika et al., 2021). Gamification, or the inclusion of game-like elements in e-learning platforms, facilitates immediate feedback to users based on their performance, enabling them to recognize their strengths and areas for improvement (Klock et al., 2019). Platforms implementing gamified learning modules can track each learner's progress more effectively by setting goals and providing a visualized learning journey.



Figure 2: Effective use of gaming elements in e-learning platforms

(Source: Handayani et al. 2020)

In numerous instances, gamification in e-learning platforms has been observed to significantly enhance user engagement, particularly among young learners, encouraging them to interact more comprehensively with the learning content. The introduction of game-like elements that reward users upon the completion of learning materials serves as a powerful motivator, prompting users to learn more efficiently and effectively (Kamunya et al., 2019). Adopting a game-structured learning approach not only augments the memory span of learners but also enriches the learning experience and contributes to academic success.

Gamified e-learning platforms are inherently more accessible and enjoyable for learners, facilitating the retention of relevant learning content for future reference. This ensures increased engagement with the e-learning platforms (Handayani et al., 2020). Developers of gamified e-learning platforms possess a unique capability to capture the interest of potential learners by offering aptly designed courses, thereby fostering enhanced engagement and learning outcomes.

The Interaction Process Through Gamification in E-Learning Platforms

In e-learning environments, game-like elements significantly assist learners in onboarding and familiarizing themselves with the platform by providing a thorough introduction to all available features. Gamification enhances the user experience by showcasing progression through the introduction of levels, points, and badges awarded after the completion of specific learning materials within set timeframes (Rebelo & Isaías, 2020). This approach fosters a sense of accomplishment among users, enabling them to complete their learning process with advanced content utilization and achieve satisfaction. Additionally, in certain instances, gamified e-learning apps reward learners with virtual currency for completing learning material within a specified period, further motivating them to engage more deeply and recognize their achievements.



Figure 3: Use of gamification in e-learning

(Source: Bennani et al. 2022)

In various instances, game-like elements, or gamification, foster engagement among all users within a learning platform by introducing challenges or quests. These activities require users to complete specific tasks or solve problems to earn rewards. This playful approach to learning encourages particularly young learners to assimilate information in an easier and more enjoyable manner (Poondej & Lerdpornkulrat, 2020). Moreover, content learned through engaging experiences tends to be memorized more easily.

The gamified learning process online is adept at building skills through challenges and quests, offering users the opportunity to acquire new skills via a hands-on learning experience (Bennani et al., 2022). For younger learners, the inclusion of storytelling elements and character development creates a meaningful connection between the learning material and the learner, enhancing relatability and long-term retention.

It has been observed that the gamification of e-learning platforms primarily aims to foster a continuous learning culture. To achieve this, they provide motivating gaming elements such as earning points, accessing exclusive content, and offering additional free course materials. These elements are designed to improve skills and encourage a deeper pursuit of knowledge (Gachkova et al., 2020).

Challenges in Gamified Learning Processes

While the learning experience through gamification on e-learning platforms can be effective, there are notable challenges that require a strategic approach to mitigate. A primary concern is that some users may focus solely on the reward-getting process in gamified learning models, which detracts from the actual learning and academic betterment (Kamunya et al., 2020). Ensuring a balanced incorporation of game-like elements with learning content is crucial to motivate genuine learning engagement. Without this balance, there is a risk that users may prioritize game enjoyment over educational content, diminishing their interaction with the available learning materials.

An excessively gamified learning process can lead to an overemphasis on gaming and rewards at the expense of learning, resulting in decreased concentration and learning outcomes (Alsubhi et al., 2021). While gamification can initially attract learners with high intensity, this engagement may wane over time, widening the gap between learning platforms and consistent user engagement. Additionally, technological challenges inherent in the gamified learning process may impede learning for those less interested in navigating these hurdles (Alsubhi et al., 2019).

Another concern is privacy; game-like elements in e-learning platforms may inadvertently prompt young learners to expose personal or sensitive information. Moreover, the addictive nature of games, coupled with an imbalance between game-like elements and educational content, can lead to increased distraction. Learners may become overly engaged with games and the reward-gathering process, thereby weakening their connection to the study materials and potentially jeopardizing their educational trajectories (Behl et al., 2022).

Methodology

Participant Selection Process:

A stratified random sampling technique was employed to select participants, ensuring a diverse and representative sample of the population engaged in or impacted by gamified learning environments. This approach aimed to gather a broad spectrum of perspectives across different demographics, including age, gender, educational background, and prior experience with e-learning platforms.

An initial screening survey was disseminated through online educational forums, social media groups focused on e-learning, and emails to educational institutions to identify individuals who had utilized or expressed interest in gamified e-learning platforms. Respondents were then stratified into groups based on their answers, promoting sample diversity regarding the aforementioned demographic factors.

Participant Backgrounds:

The study included 60 participants, with deliberate efforts to ensure balanced representation across various demographics:

- **Age Groups:** Participants were categorized into four age brackets—18-30, 31-45, 46-60, and over 60—to explore the effects of gamification across different life stages.
- **Gender:** Aiming for gender balance, the study also provided an option for participants who preferred not to disclose their gender, highlighting the commitment to inclusivity.
- **Educational Background:** The participant pool ranged from high school graduates to individuals with postgraduate degrees, facilitating an analysis of how educational attainment influences responses to gamified learning.
- **Experience with E-learning Platforms:** To gauge the impact of prior e-learning exposure, participants were queried about their familiarity and frequency of using such platforms, including any previous experiences with gamified learning environments.

Data Collection Instruments and Procedure:

The survey employed a mix of Likert-scale items and multiple-choice questions to evaluate participants' engagement, motivation, and knowledge retention within gamified learning contexts. Open-ended questions were included to gather qualitative insights into personal experiences with gamified e-learning platforms.

To affirm the survey's reliability and validity, a pilot test was conducted with a small segment of the target demographic. Feedback from this test informed adjustments to the survey questions and design to enhance clarity and comprehensiveness.

Data Analysis Strategy:

Quantitative data from the survey were analyzed using SPSS software, applying descriptive statistics, multiple regression analysis, and correlation analysis to explore the relationship between gamification elements and learning outcomes. Qualitative responses underwent thematic analysis to identify common themes and perceptions regarding gamified learning experiences.

Findings and Analysis

Analysis of demographic profile

The study provides an in-depth discussion on demographic profiles through the analysis of demographic information. The perceptions of the participants are illuminated by examining demographics, where the age, gender, and occupation of individuals have been analyzed to understand their suitability for responding to the survey questions.

Gender:

Table 1: Gender Analysis

What is your Gender?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Female	26	43.3	43.3	43.3
Male	26	43.3	43.3	86.7
Prefer not to say	8	13.3	13.3	100.0
Total	60	100.0	100.0	

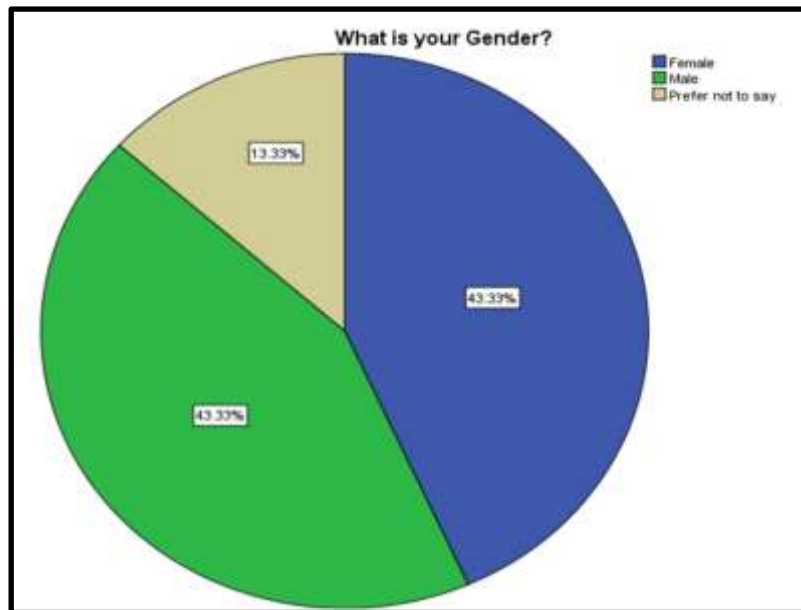


Figure 4: Analysis of the gender of participants

Age:

Table 2: Age Analysis

What is Your Age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-30	19	31.7	31.7	31.7
	31-45	17	28.3	28.3	60.0
	46-60	16	26.7	26.7	86.7
	Above 60	8	13.3	13.3	100.0
	Total	60	100.0	100.0	

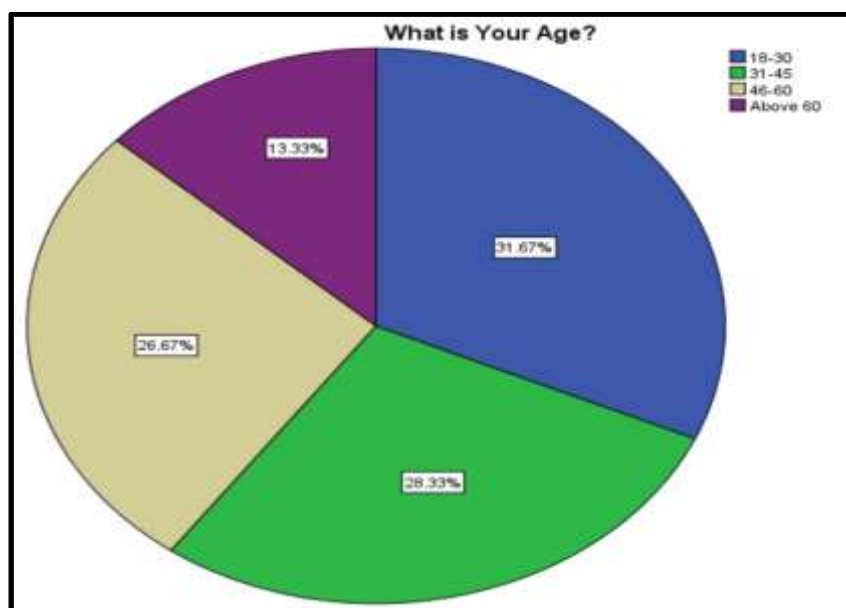


Figure 5: Analysis of the age of participants

Profession:

Table 3: Profession Analysis
What is your profession?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid E-learning platform developer	18	30.0	30.0	30.0
Others	8	13.3	13.3	43.3
Student	17	28.3	28.3	71.7
Teacher	17	28.3	28.3	100.0
Total	60	100.0	100.0	

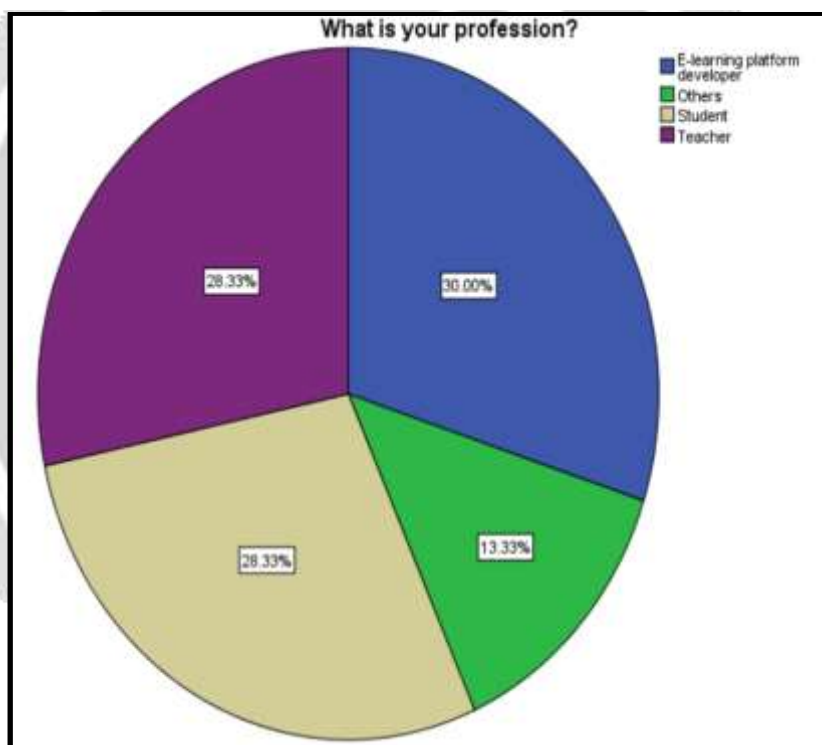


Figure 6: Analysis of the profession of participants

The demographic distribution of the survey participants is detailed across Figures 4 to 6 and Tables 1 to 3, highlighting age, gender, and profession. Among the 60 randomly selected participants, 26 identified as female and 26 as male, while 8 preferred not to disclose their gender identity. Consequently, both female and male participants constitute an equal share of 43.33% of the total responses each, whereas individuals opting not to disclose their gender identity represent the smallest group, with 13.33% of responses.

The age group distribution shows that individuals aged 18-30 were the most represented, accounting for 31.67% of total participation. In contrast, those above 60 years of age constituted the smallest respondent group, with 13.33% of overall participation. Professionally, e-learning platform developers were the most responsive, making up 30% of total responses.

Descriptive analysis

Table 4: descriptive table presented by SPSS analysing tool

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
gamified approaches (DV)	60	1	5	3.30	1.306
increasing engagement learning in the e-learning apps (IV 1)	60	1	5	3.45	1.431
prompt a sense of achievement (IV 2)	60	1	5	3.30	1.306
higher level of motivation to learn better and faster (IV 3)	60	1	5	3.30	1.306
Valid N (listwise)	60				

The central tendency of the variables in this study is examined through descriptive analysis. The mean values, as presented in Table 4, range between 3.30 and 3.45. Additionally, the skewness value is incorporated into the descriptive analysis to provide insights into the data distribution. A skewness value greater than +1 indicates a right-skewed distribution, whereas a value less than -1 suggests a left-skewed distribution. It is important to note a potential typo in the original text regarding the skewness value; typically, skewness is considered significant if it is beyond the -1 to +1 range rather than -5. In Table 4, the mean values range from 3.30 to 3.45, which fall within the expected range, providing a central perspective on the dataset's distribution.

Multiple Regression

Hypothesis 1: Gamified approaches and the increasing engagement in learning in the e-learning apps show a positive correlation

Table 5: analysis of regression for hypothesis 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000 ^a	1.000	1.000	.000

a. Predictors: (Constant), higher level of motivation to learn better and faster (IV 3)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	100.600	1	100.600		^b
	Residual	.000	58	.000		
	Total	100.600	59			

a. Dependent Variable: gamified approaches (DV)

b. Predictors: (Constant), higher level of motivation to learn better and faster (IV 3)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.000	.000			
	higher level of motivation to learn better and faster (IV 3)	1.000	.000	1.000		

a. Dependent Variable: gamified approaches (DV)

Table 5 presents an R-value of 1, an R-square value of 1, and an adjusted R-square value of 1, indicating a perfect linear relationship. The analysis reveals a significance value of .000, demonstrating highly significant results. With the R-value being close to 1 and the significance value being less than 0.05, this data strongly supports the first hypothesis, suggesting a strong and significant relationship as per the variables analyzed.

Hypothesis 2: There is a strong positive bond between Gamified approaches in e-learning apps and the sense of achievement of students

Table 6: analysis of regression for Hypothesis 2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000 ^a	1.000	1.000	.000

a. Predictors: (Constant), prompt a sense of achievement (IV 2)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	100.600	1	100.600	.	. ^b
	Residual	.000	58	.000		
	Total	100.600	59			

a. Dependent Variable: gamified approaches (DV)

b. Predictors: (Constant), prompt a sense of achievement (IV 2)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.000	.000		.	.
	prompt a sense of achievement (IV 2)	1.000	.000	1.000	.	.

a. Dependent Variable: gamified approaches (DV)

Table 6 presents an R-value of .798, indicating a strong linear relationship between the variables. It also shows an R-square value of 1 and an adjusted R-square value of 1, suggesting that the model explains all the variability of the response data around its mean. The analysis reports a significance value of .000, demonstrating highly significant results. Given the R-value is close to 1 and the significance value is less than 0.05, this data robustly supports the second hypothesis, indicating a significant relationship as per the variables analyzed.

Hypothesis 3: The relation between the Gamified learning approach and a higher level of motivation to learn better and faster is positive and strong

Table 7: analysis of regression for hypothesis 3**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.970 ^a	.940	.939	.323

a. Predictors: (Constant), increasing engagement learning in the e-learning apps (IV 1)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	94.560	1	94.560	908.071	.000 ^b
	Residual	6.040	58	.104		
	Total	100.600	59			

a. Dependent Variable: gamified approaches (DV)

b. Predictors: (Constant), increasing engagement learning in the e-learning apps (IV 1)

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.248	.110		2.267	.027
	increasing engagement learning in the e-learning apps (IV 1)	.885	.029	.970	30.134	.000

Table 7 displays an R-value of .970, an R-square value of .940, and an adjusted R-square value of .939, indicating a very strong linear relationship between the variables under study. The analysis also reveals a significance value of .000, pointing to highly significant results. With the R-value being notably close to 1 and the significance value well below the threshold of 0.05, this data compellingly supports the third hypothesis, demonstrating a significant and robust relationship according to the variables analyzed.

Analysis of correlation

Table 8: Analysis of correlation

		Correlations			
		gamified approaches (DV)	increasing engagement learning in the e-learning apps (IV 1)	prompt a sense of achievement (IV 2)	higher level of motivation to learn better and faster (IV 3)
gamified approaches (DV)	Pearson Correlation	1	.970**	1.000**	1.000**
	Sig. (2-tailed)		.000	.000	.000
	N	60	60	60	60
increasing engagement learning in the e-learning apps (IV 1)	Pearson Correlation	.970**	1	.970**	.970**
	Sig. (2-tailed)	.000		.000	.000
	N	60	60	60	60
prompt a sense of achievement (IV 2)	Pearson Correlation	1.000**	.970**	1	1.000**
	Sig. (2-tailed)	.000	.000		.000
	N	60	60	60	60
higher level of motivation to learn better and faster (IV 3)	Pearson Correlation	1.000**	.970**	1.000**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	60	60	60	60

** . Correlation is significant at the 0.01 level (2-tailed).

Table 8 in this study presents the correlation values that are instrumental in determining the relationship between the variables. The Pearson Correlation Test is employed to evaluate the strength of this relationship, indicating a strong correlation between the variables in this instance. This assessment helps in understanding the degree to which the variables move in relation to one another.

Discussion

The incorporation of game-like elements in e-learning platforms effectively captures users' attention and fosters their active participation in the learning process. This approach has the potential to significantly increase engagement with the educational content provided by these platforms (Saleem et al., 2022). Learning materials endowed with game-like features that reward completion motivate users to learn more efficiently and effectively. Furthermore, the learning experience is enriched, and learners' memory spans are expanded through the structured approach of game-based learning (Gachkova et al., 2020). The gamification process, highlighted by the introduction of levels, points, and badges for completing specific tasks within designated times, underscores the progression mechanism. This feature engenders a sense of accomplishment among all participants (Bouchrika et al., 2021).

However, gamification in learning may lead some students to prioritize game victories and rewards over the acquisition of new knowledge beneficial for their long-term educational goals. Such a focus can result in diminished concentration and degraded learning outcomes.

Conclusion

The employment of the quantitative data collection method in this study has been instrumental in illuminating how gamified learning experiences can enhance user motivation to engage with e-learning platforms. The responses from survey participants have been meticulously analyzed to yield insightful results regarding the pivotal elements of this study. This analysis has effectively bridged the gap between the findings and pre-existing knowledge, showcasing the significant impact of gamification on the learning process.

Practical Implications

To effectively implement gamification in e-learning platforms, developers should prioritise creating personalised learning paths that meet the needs of individual learners, incorporating progression mechanics such as levels and badges to visually represent and reward progress, and providing real-time feedback to reinforce learning. Social learning features should also be included to encourage interactivity, collaboration, and competition among students. Drawing inspiration from successful case studies, such as Duolingo, which uses a

combination of these strategies to improve language learning via gamification, can provide useful insights. Key recommendations include creating a diverse rewards system to appeal to various motivational drivers, involving learners in the design process for user-centered gamification elements, and ensuring that all gamified features are accessible and inclusive to accommodate a diverse range of learners.

Limitations and Future Research

The study on gamification in e-learning platforms offers valuable insights into improving student engagement, motivation, and knowledge retention. However, its limitations, such as the small sample size, lack of cultural diversity, reliance on quantitative data, cross-sectional design, and self-reported measures, highlight areas for improvement. Future research should include longitudinal studies to investigate the long-term effects of gamification, diverse cultural perspectives to understand gamification's global applicability, qualitative methods for deeper insights into learner experiences, and the impact of personalised gamification strategies. Addressing these issues will improve our understanding of gamified learning's efficacy and role in the future of educational technology.

References

1. Alsubhi, M. A., Ashaari, N. S., & Wook, T. S. M. T. (2019, July). The challenge of increasing student engagement in e-learning platforms. In *2019 International Conference on Electrical Engineering and Informatics (ICEEI)* (pp. 266-271). IEEE. https://www.researchgate.net/profile/Mohammed_Alsubhi9/publication/339173656_The_Challenge_of_Increasing_Student_Engagement_in_E-Learning_Platforms/links/621673856164255c72fe170b/The-Challenge-of-Increasing-Student-Engagement-in-E-Learning-Platforms.pdf
2. Alsubhi, M. A., Ashaari, N. S., & Wook, T. S. M. T. (2021). Design and evaluation of an engagement framework for e-learning gamification. *International Journal of Advanced Computer Science and Applications*, *12*(9). https://www.researchgate.net/profile/Mohammed_Alsubhi9/publication/355085658_Design_and_Evaluation_of_an_Engagement_Framework_for_e-Learning_Gamification/links/61c0bffd4b318a6970f63973/Design-and-Evaluation-of-an-Engagement-Framework-for-e-Learning-Gamification.pdf
3. Behl, A., Jayawardena, N., Pereira, V., Islam, N., Del Giudice, M., & Choudrie, J. (2022). Gamification and e-learning for young learners: A systematic literature review, bibliometric analysis, and future research agenda. *Technological Forecasting and Social Change*, *176*, 121445. https://researchprofiles.herts.ac.uk/files/26579293/TFSC_R2_gamification.pdf
4. Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, *30*(2), 628-642. https://www.researchgate.net/profile/Souha-Bennani/publication/356716897_Adaptive_gamification_in_E-learning_A_literature_review_and_future_challenges/links/62e506474246456b55f6fc61/Adaptive-gamification-in-E-learning-A-literature-review-and-future-challenges.pdf
5. Bouchrika, I., Harrati, N., Wanick, V., & Wills, G. (2021). Exploring the impact of gamification on student engagement and involvement with e-learning systems. *Interactive Learning Environments*, *29*(8), 1244-1257. https://eprints.soton.ac.uk/432025/2/Wills_Jul_2019.pdf
6. Deci, E. L., & Ryan, R. M. (2012). Self-determination theory. Handbook of theories of social psychology. *Social Constructs of Motivation*, 54-67.
7. Gachkova, M., Somova, E., & Gaftandzhieva, S. (2020, June). Gamification of courses in the e-learning environment. In *IOP conference series: Materials science and engineering* (Vol. 878, No. 1, p. 012035). IOP Publishing. <https://iopscience.iop.org/article/10.1088/1757-899X/878/1/012035/pdf>
8. Handayani, V., Budiono, F. L., Rosyada, D., Amriza, R. N. S., & Masrurroh, S. U. (2020, October). Gamified learning platform analysis for designing a gamification-based ui/ux of e-learning applications: A systematic literature review. In *2020 8th International Conference on Cyber and IT Service Management (CITSM)* (pp. 1-5). IEEE. <https://ieeexplore.ieee.org/abstract/document/9268791/>
9. Hassan, M. A., Habiba, U., Majeed, F., & Shoaib, M. (2021). Adaptive gamification in e-learning based on students' learning styles. *Interactive Learning Environments*, *29*(4), 545-565. https://www.researchgate.net/profile/Narmin-Noori/publication/348161943_Gamification_Applications_in_E-learning_A_Literature_Review/links/5ff85e1b92851c13fef87303/Gamification-Applications-in-E-learning-A-Literature-Review.pdf

10. Kamunya, S., Maina, E., & Oboko, R. (2019, May). A gamification model for E-learning platforms. In *2019 IST-Africa Week Conference (IST-Africa)* (pp. 1-9). IEEE. <https://ir-library.ku.ac.ke/bitstream/handle/123456789/23106/A%20Gamification%20Model%20For%E2%80%A6.pdf?sequence=1>
11. Kamunya, S., Mirirti, E., Oboko, R., & Maina, E. (2020, May). An adaptive gamification model for e-learning. In *2020 IST-Africa Conference (IST-Africa)* (pp. 1-10). IEEE. <https://ir-library.ku.ac.ke/bitstream/handle/123456789/20359/An%20Adaptive%20Gamification%20Model%20for%20E-Learning.pdf>
12. Kashive, N., & Mohite, S. (2023). Use of gamification to enhance e-learning experience. *Interactive Technology and Smart Education*, 20(4), 554-575. <https://www.emerald.com/insight/content/doi/10.1108/ITSE-05-2022-0058/full/html>
13. Klock, A. C. T., Gasparini, I., & Pimenta, M. S. (2019). User-centered gamification for e-learning systems: A quantitative and qualitative analysis of its application. *Interacting with Computers*, 31(5), 425-445. https://www.researchgate.net/profile/Ana-Klock/publication/345397356_User-Centered_Gamification_for_E-Learning_Systems_A_Quantitative_and_Qualitative_Analysis_of_its_Application/links/60a4da0d4585158ca05d2954/User-Centered-Gamification-for-E-Learning-Systems-A-Quantitative-and-Qualitative-Analysis-of-its-Application.pdf
14. Poondej, C., & Lerdpornkulrat, T. (2020). Gamification in e-learning: A Moodle implementation and its effect on student engagement and performance. *Interactive Technology and Smart Education*, 17(1), 56-66. <https://www.emerald.com/insight/content/doi/10.1108/ITSE-06-2019-0030/full/html>
15. Rebelo, S., & Isaiás, P. (2020). Gamification as an engagement tool in e-learning websites. *Journal of Information Technology Education: Research*, 19. <https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=15479714&AN=161573258&h=QvBO5RJmYcXHWuiq91sgVzbUotbAa1dO2VbuQggQPS%2Bze7V%2B02dby8kERR%2BoY68F15yUWPc1Zvy7upDI8WmS%2FA%3D%3D&crl=c>
16. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55(1), 68.
17. Saleem, A. N., Noori, N. M., & Ozdamli, F. (2022). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, 27(1), 139-159. https://www.researchgate.net/profile/Narmin-Noori/publication/348161943_Gamification_Applications_in_E-learning_A_Literature_Review/links/5ff85e1b92851c13fef87303/Gamification-Applications-in-E-learning-A-Literature-Review.pdf
18. Saleem, A. N., Noori, N. M., & Ozdamli, F. (2022). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, 27(1), 139-159. https://www.researchgate.net/profile/Narmin-Noori/publication/348161943_Gamification_Applications_in_E-learning_A_Literature_Review/links/5ff85e1b92851c13fef87303/Gamification-Applications-in-E-learning-A-Literature-Review.pdf
19. Snyder, C. R., & Lopez, S. J. (Eds.). (2001). *Handbook of positive psychology*. Oxford university press.
20. Statista, (2022) Size of the global e-learning market in 2019 and 2026, by segment retrieved from: <https://www.statista.com/statistics/1130331/e-learning-market-size-segment-worldwide/> on 23rd December, 2023
21. Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive science*, 12(2), 257-285.
22. Sweller, J., Ayres, P., Kalyuga, S. (2011). The expertise reversal effect. *Cognitive load theory*, 155-170.