

Gamification Through ICT Tools and Student Engagement in Online Learning

Amarjeet Kaur¹, R. Varalakshmi², Randeep Singh Dhillon³, Jaya Ganesan⁴, R. Selvakumari⁵

¹IMT Nagpur LRC, IMT Nagpur Campus, Nagpur, Maharashtra, India.

ORCID: 0009-0005-0745-2741

²M.Sc. Data Science and Artificial Intelligence, Shrimathi Devkunvar Nanalal Bhatt Vaishnav College for Women, India.

ORCID: 0000-0002-1171-9825

³University Institute of Computing, Chandigarh University, Mohali – 140413, Punjab, India.

⁴Alliance School of Business, Alliance University, Bengaluru, Karnataka, India.

ORCID: 0000-0001-8890-7851

⁵Department of Business Administration, SRM Trichy Arts and Science College, Tamil Nadu, India.

ORCID: 0000-0001-8662-2668

Abstract: Due to the fast-paced development of online learning, new pedagogical solutions are needed that can maintain students' attention, engagement and motivation during digital learning. The gamification concept coupled with Information and Communication Technology (ICT) tools is a promising way to make online learning interactive, participatory and learner-centred. This research focuses on the role of gamification in the context of using information and communication technologies to improve the learning experience of students in online learning environments. It's based on the implementation of gamification features like points, badges, leaderboards, challenges, rewards, progress indicators, quizzes and interactive feedback to motivate students to be actively involved in learning tasks. Student engagement is defined in terms of behavioural, emotional, cognitive and social aspects. Special focus is put on the potential impact of gamified ICT tools on motivation, learning participation, persistence, peer and instructor interaction, and online learning activity completion. This study will use quantitative research methodology with a primary data collection method for students who have experience using technology in online learning. The relationship between the gamification practices and the students' engagement can be analyzed by using descriptive statistics, correlation analysis and regression analysis. It is hoped that the study will be able to provide evidence that the use of gamification in the learning process can improve the student's involvement and motivation when the object of the gamification is already in the learning process, not just as a form of play. The outcomes can assist teachers, schools and instructional designers to design meaningful and interactive learning activities using the ICT's. The study also highlights the importance of being aware of learner diversity and accessibility, creating rewarding experiences and pedagogical design that can lead to meaningful and sustainable learning with the support of gamification.

Keywords: Gamification, ICT tools, student engagement, online learning, digital pedagogy, learner motivation, technology-enhanced education

1. Introduction

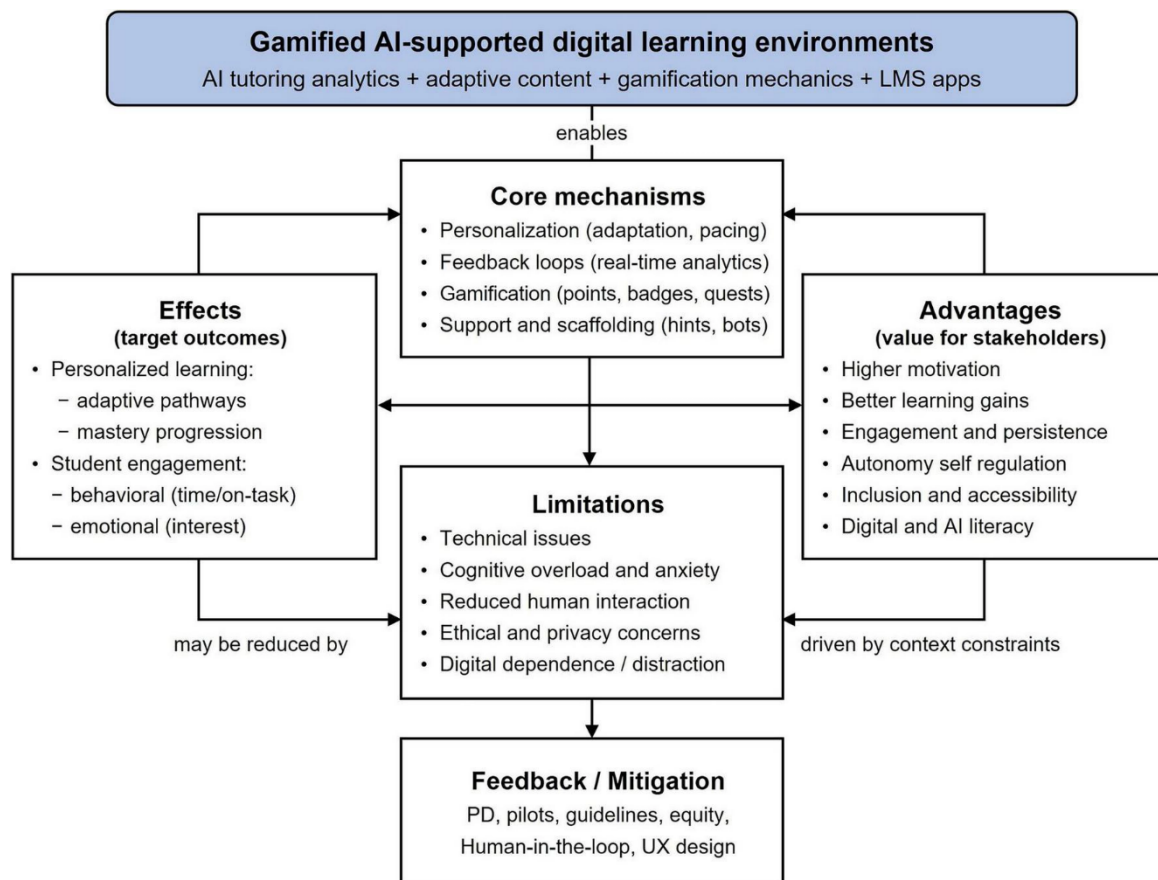
Information and Communication Technology (ICT) has revolutionized education by making learning possible outside of the classroom and providing students with access to learning content via digital platforms, virtual classrooms, mobile apps, learning management systems and online, interactive learning environments. Online learning has flexibility, reach and individualization, however it is still challenging to ensure that students pay attention and get involved in learning. Students in distance education may find they have less interaction, social presence, attention and motivation, particularly if the teaching methods are primarily passive. In this context the use of pedagogical innovations based on ICTs is becoming more and more widespread in the design of meaningful and engaging learning experiences.



One such approach that has come to the fore is gamification: the use of elements from the game design to help motivate participation and improve learners' motivation in non-game learning settings. Points, badges, levels, leaderboards, challenges, rewards, progress indicators, quizzes, feedback mechanisms and digital competitions are some of the features that can help make online learning environments more interactive. Gamification does not promise a complete gamification in the field of education, but it wants to integrate the motivational elements of games into learning. If aligned properly with instruction goals, these can give learners instant feedback, see progress, have goals to achieve and feel the sense of accomplishment.

The use of gamification and ICT is especially important for online learning since the digitalization of platforms can help in the implementation and supervision of the game-based aspects. With learning management systems, teachers can construct activities that foster participation and ongoing engagement through educational apps, virtual classrooms, interactive quiz apps, digital badges, and collaborative tools. These technologies can also offer a teacher with information on how well a student participates, how long the student takes to complete a task, how they do a task, and how much they learn as a result. This means that ICT-based gamification can transform the delivery of online education from content-centred to more participatory and learner-centred experiences.

Engagement with students is not one-dimensional and goes beyond just log-in or log-out of online activities. It refers to behavioural involvement, emotional involvement, mental involvement, peer and teacher interactions, and willingness to do work on learning tasks. Gamification could impact these dimensions by providing structured challenges, feedback, autonomy, competition, collaboration, and recognition. The effectiveness of gamification, however, is not guaranteed. Too much competition, inappropriate incentives, repetitive exercises, and too much focus on external motivation can decrease the internal motivation and cause learners to become disengaged. Thus, the educational benefits of gamification are deeply rooted in the consideration of game elements in relation to the learning objectives, student characteristics, assessment, and online learning context.



Source: <https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2026.1754080/full>

In this context, it is crucial to analyse the connection between gamification of learning with the use of ICT tools and the involvement of students in online learning to gain insight into how the use of ICT tools in pedagogical practice

can facilitate more active and motivating online learning. The present study examines the possibility of using gamification in online learning supported by ICT in improving the participation, motivation, interaction, and involvement in online learning by students. The study aims to offer insights that help educators and institutions create online learning environments that are engaging, purposeful, and learner-centred by looking at these dimensions.

2. Background of the study

Digital technologies have revolutionized the learning environment at a very fast pace, impacting upon the design, delivery and experience of learning and teaching. With the flexibility of time, place, and access to educational resources, online learning has become an important part of today's education. Institutions have been able to bring education beyond the walls of the classroom through learning management systems, video-conferencing platforms, digital classrooms, mobile applications, discussion forums, and interactive learning resources. The advantages of online learning do not, however, mean that everyone is necessarily active. Keeping students focused, motivated, engaged, and actively participating are major challenges in online courses where there is a lot of passive content consumption.

Student engagement is one of the factors that can affect the quality and effectiveness of online learning. Engagement involves what the learner does about the learning, what the learner feels about the learning, what the learner thinks about the learning, and what the learner interacts with from the teachers, peers, and learning activities. Students in the virtual environment can feel isolated, distracted by other digital activities, lack of immediate feedback and reduced social interaction. These can impact a person's engagement with discussion, learning activities, sticking with coursework and desire to engage with the teacher and class. Therefore, the ways educators and institutions can make online learning more interactive, meaningful and motivating are in the spotlight. One such method has been introduced as gamification. It is the use of selected elements and principles of a game in an application or context outside of the game. It is the use of selected elements and principles of a game in an out-of-game context to encourage participation and influence user experiences and behaviours. Gamification in education can include elements such as points, badges, levels, leader boards, challenges, rewards, progress indicators, quizzes, missions, digital storytelling, and instant feedback. Educational gamification is not about changing education into a game but about introducing motivational and interactive aspects to make students more active to participate in learning activities. If they are planned effectively, these can give learners clear objectives, progress that can be seen, opportunities to achieve, and regular feedback.

With the advent of information and communication technology (ICT) there are a lot more ways to apply gamification in online education. Digital platforms enable automatic issuance of points and badges, tracking of learner progress, offering feedback on performance, creating challenges, and enabling interaction among learners. Interactive quiz apps, gamified LMS, virtual simulations, learning apps, and collaborative digital platforms are thus able to assist in various forms of gamified learning experiences. The technologies also give teachers the chance to create activities that cater to various learning styles, and motivate students to be more active learners. But the connection between gamification and student engagement is not always clear-cut. The effectiveness of gamified ICT tools is dependent of the integration with learning goals, teaching methods, assessment methods and the personal characteristics of learners.

Excessive external motivation can result in game mechanics and not learning. Likewise, the use of competition – such as leaderboards – can encourage some learners, while discouraging others. However, gamification that is poorly designed can also lead to undesirable competition, cognitive overload, or disruption from the intended learning content. Thus, the learning value of gamification is not just about introducing gamification elements, but about creating meaningful learning experiences where technology, pedagogy, motivation, and learning goals are well aligned. From an educational standpoint, gamification can possibly reinforce several aspects of student engagement. Engagement can be gained via quizzes, challenges, tasks or group activities. Students might get emotionally involved when they enjoy the online learning experience, when they feel successful, appreciated, and connected to something. Gamifying activities might involve problem solving, decision making, applying concepts and providing feedback on the outcome of such activities, which can foster cognitive engagement. Social engagement may also be fostered by team challenges, by interactions among peers, by collaborative challenges, and by learning tasks that are shared.

Online education with ICTs is thus becoming widely adopted and it is important to question the effect of gamification on meaningful student engagement. There are many ways to insert game components into a technological tool, but there is a need to evaluate the effectiveness of the use of these tools based on what the user actually experiences and how much he participates. It is crucial to know which gamification elements are more effective, how students react to various motivation strategies, and if they have the potential to interact in the long term. In this context, the current study aims at “Gamification with the use of ICT Tools and Student Engagement in e-Learning.” This study

aims to investigate how gamification using ICTs can stimulate students to be more active in online learning environments. It is also important to be aware of how digital game elements can be incorporated with good teaching practices in order to improve the learning process in more significant, participatory and empowered ways. This type of investigation is particularly relevant given the interest in using technology in a variety of ways to increase learners' engagement in learning without reducing the purpose and meaning of learning.

Justification

With the growth of online learning, there are new opportunities for flexibility and accessibility in education as well as new issues to consider regarding student attention, participation, motivation and sustained engagement. In an online-learning environment, it may be necessary for the students to plan their learning activities on their own, without the direction and human interaction provided in a classroom. As a result, students may find themselves unable to focus, to passively engage with lessons, to feel isolated, and find it hard to sustain engagement with learning. All these challenges underscore the potential of pedagogical strategies that will help to make online learning more participative, interactive and learner-centred.

This could be solved with the use of Gamification tools through Information and Communication Technology (ICT). Gamification of assessment activities can incorporate game elements—such as points, badges, levels, challenges, leaderboards, rewards, quizzes, feedback and progress indicators—into digital learning environments for educators to make them more engaging for the learners. When used effectively, gamification can engage learners, encourage them to be more active, pay attention to what they're learning, listen to feedback, and otherwise be immersed in what they're learning. ICT platforms can also be used to integrate these features into virtual classrooms, learning management systems, mobile apps, interactive quizzes and collaborative learning spaces.

The motivation behind the current study is to investigate whether the use of gamified ICT tools can make a meaningful contribution to the engagement of the students in e-learning. Engagement is a multi-dimensional phenomenon and is more than just participation: behavioural engagement, emotional engagement, cognitive engagement, interaction and commitment to learning tasks. These dimensions could be used to provide a more comprehensive understanding of the students' response to the gamified online learning experiences.

Furthermore, the gamification approach might be different depending on the students' level of technology knowledge and learning style, their motivation, age, school background, and their habits in using technology. Therefore, it is crucial to systematically explore and not presume that all gamified activities will lead to greater engagement in learning. It can determine which practices of gamification with ICTs are considered useful and interesting and which factors hinder the effectiveness of these practices.

The results of the study could have practical applications for instructors, schools, instructional designers, and policy makers. Teachers can leverage the results to create more interesting online learning experiences, and institutions can use the results to make decisions about which and how to use digital learning technologies. The study can also be a valuable addition to the academic debate concerning the role of technology for pedagogy by analyzing the pedagogical approach of gamification rather than only a technological tool.

For this reason, the study is justified due to the increasing role of online learning and the need to create meaningful learning, interactive and sustainable strategies for engaging students. The study of gamification in the use of ICT tools can help to understand better how digital learning environments can be created to make online learners more active participants, more motivated, interact and persist.

Objectives of the Study

1. To Investigate the level of gamification-based ICT tools use in online learning environments.
2. To measure the extent of student online learning engagement, in terms of behavioural, emotional and cognitive aspects.
3. The aim of this analysis was to determine how effective gamification is in the use of ICT tools to engage students in online learning.
4. To select the key gamification components (points, badges, leaderboard, challenges, rewards, feedback, and progress tracking) and understand how they play the greatest role in student engagement.
5. To investigate students' perception and attitude towards using gamified ICT tools in online learning.

3. Literature Review

Gamification as a learning pedagogical approach has become a significant factor in the improvement of students' engagement, motivation, participation and persistence in online learning. Gamification, in general terms, is the use of game elements (points, badges, levels, challenges, leaderboards, feedback, rewards) in non-game learning contexts. To understand the application of gamification in education, we will use the framework of Deterding et al. (2011) who defined gamification as the application of game design elements in non-game contexts. Gamification is especially beneficial in online learning environments, where digital platforms can embed interactive learning activities, real-time feedback, progress monitoring and reward systems into everyday learning.

Gamification–Student Engagement relationship has been studied from a motivational and behavioural point of view. Kapp (2012) contended that this approach of layering learning content with challenge, feedback, and meaningful progression can transform the learning experience into something more interactive. From this view, the game-based learning environments can enable learners to engage in learning more than traditional methods of delivering content. Likewise, Hamari et al. (2014) conducted a systematic review of empirical research and found that gamification is able to have positive impact on motivation, engagement, and learning; however, the impact of gamification can vary significantly based on the context and implementation of individual gamification mechanisms.

Motivation is one of the key factors that links gamification and student engagement. Ryan and Deci (2000) highlighted in their self-determination theory that people are more likely to exhibit prolonged motivation when their needs for autonomy, competence, and relatedness are met. ICT-based gamification has the potential to meet such requirements, as students can choose activities, track their progress, show their skills through challenges and communicate with others. Sailer et al. (2017) discovered that certain game characteristics can impact psychological experiences linked to motivation. They argue that gamification as a whole should not be considered as a single intervention but rather elements of the gamification can affect the learner in various ways.

Hanus and Fox (2015) also point out the significance of game aspects in the engagement of students in learning. Their research indicates that proper implementation of gamification is not guaranteed to have a positive impact on education and that over-emphasis on competitive aspects can lead to a negative motivation and satisfaction in the long term. It has significance for online learning because some students could be encouraged by leaderboards and competitive rankings, while others are demoralized. Thus, designing gamified ICT environments should take into account students' individual preferences, learning needs, and motivational traits and not only external rewards.

Gamification as a solution for enhancing behavioural engagement has also been studied. Domínguez et al. (2013) studied gamified learning experiences and found an improvement in some elements of the students' learning performance. The researchers also pointed out, however, that gamification doesn't necessarily have a positive effect on all aspects of academic performance. This means that the elements of the game are best integrated with the learning objectives and not just for entertainment.

In an online environment, the interaction and involvement of learners are especially important as students may have less social presence and spontaneous interaction within the classroom setting. Student engagement was identified by Krause and Coates (2008) as a multidimensional construct that includes academic, intellectual, social and behavioural elements. ICT-supported gamification may support these dimensions by providing opportunities for interaction, collaboration, real-time feedback and visibility, and progress. Likewise, Martin and Bolliger (2018) noted the need for engagement strategies in an online learning environment, especially those that foster interaction between students, instructors, and learning materials.

Another important aspect of gamification in online learning is the use of feedback. Formative feedback can help the learning process when it gives them information about their performance that is useful, and can help them to find ways to improve (Shute, 2008). Gamification platforms are often equipped with scores, progress bars, achievement notifications, and performance dashboards, which offer instant feedback. These mechanisms can help students discover their strength and weakness and stimulate their involvement. Feedback should be informative and re-connected to learning targets NOT as a reward.

Furthermore, the ICT tools for delivering learning activities both in terms of their design and quality have an impact on the effectiveness of gamification. It is mentioned by Mishra & Koehler (2006) that technology in education requires a proper relationship between technology, pedagogy and content of the subject which is referred to as Technological Pedagogical Content Knowledge. Gamification should not be interpreted as “merely” adding digital game elements in this context. On the contrary, educators have to figure out how particular gamified tools can work to facilitate instructional methods and discipline learning goals. Gamification can also increase the technological challenge without any pedagogical benefits.

The previous studies on gamification in education have yielded mixed findings and Clark et al. (2016) have found several factors that make a difference in the success of gamified interventions, such as the settings in which the interventions are implemented, the characteristics of the learners, and the kind of game mechanics used. This finding shows the need to research not only the presence of gamification, but also gamification design and student experience with gamification. Therefore, gamification can be effective when it comes to the meaningful challenge, opportunities for collaboration, feedback and achievable progression that ICT tools provide in online learning.

The other great challenge is the short term and long term. Hamari and Koivisto 2015 have identified the perceived usefulness and the social factors in their study to influence attitude towards gamification and willingness to use gamified systems. In an educational setting, students may be motivated to play for the game's rewards or because it is a new game, but lose interest if the game is not educationally relevant. Therefore, gamification cannot be used without implementing meaningful learning experiences; otherwise, it will not become a long-term engagement.

Sailer and Homner (2020) conducted a meta-analysis of the 48 studies they located to further examine the link between gamification and learning outcomes and found that the overall effect of gamification on cognitive, motivational, and behavioural learning outcomes was generally positive, with the magnitude of the effects dependent on the design of the gamified intervention. Their study offers validation for the promise of gamification and reveals that results are not transferable to all education contexts. The choice and match between game elements continue to be key factors of effectiveness.

Social interaction also has an impact on student engagement in digitally mediated environments. Deci and Ryan (2008) highlighted the role of autonomy, competence and relatedness in the development of internal motivation and psychological wellbeing. Peer challenges, collaborative missions, discussion activities, various team-based achievements can be used to support relatedness on gamified ICT platforms. These features can help to minimize feelings of isolation in an online learning environment and foster a sense of belonging. But, social features need to be made inclusive such that competition does not affect those with varying technical skills and confidence in their academic abilities.

Gamification has also been increasingly explored in more recent studies in the context of digital learning technologies in general. Zainuddin et al. (2020) found that using gamification has a great potential to be applied for supporting student motivation and engagement in technology-enhanced learning, and also found that further and longer-term studies are needed, with better research designs. Their analysis indicates that educational value of gamification is dependent on the match between game mechanics and pedagogical goals.

Overall, the literature suggests that gamification with ICT tools can be used to improve student engagement in online learning, increasing students' motivations, participation, interaction, feedback, and their sense of progress. However, current evidence does not suggest that all activities using the gamification methods are indeed conducive to learning. Hanus and Fox (2015) and Clark et al. (2016) provide evidence of the value of careful design, and Sailer et al. (2017) and Sailer and Homner (2020) show that certain game elements can have differential effects. The literature thus suggests a need for research on the most effective types of ICT-based gamification for maintaining student engagement, student perceptions of various game mechanics and whether student engagement leads to meaningful learning outcomes in an online setting. The interaction between gamification design, learner motivation, technological accessibility, and sustained engagement in various online learning contexts can then be the target of future empirical studies.

4. Material and Methodology

The study used a quantitative research method to analyze the relationship between gamification using the Information and Communication Technology (ICT) tools and the engagement of students in online learning. The descriptive and analytical research design was used to gain understanding of the experiences of students in gamified online learning environments and whether the use of gamification features (points, badges, leaderboards, challenges, quizzes, rewards, progress indicators, and interactive activities) was linked to higher student engagement levels. The study was conducted with students who had experience in online or technology mediated learning activities in Higher Education Institutions.

Primary data was used in the study; the data was collected directly from the students using a structured questionnaire. The questionnaire was designed with reference to the key dimensions of gamification and student engagement from literature in educational technology. The gamification element comprised the following statements: exposure to gamified ICT tools, perceived enjoyment, interactive learning activities, rewards and feedback,

competition, progress tracking, and motivation to engage in the learning activity. Student engagement was measured in three ways: behavioural, emotional, and cognitive, measured by the following indicators: participation in online activities, attentiveness during virtual classes, willingness to complete learning activities, interaction with teacher, interaction with peers, interest in the content of the course, and involvement in autonomous learning. Answers were taken on a 5-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Prior to the main data collection, the questionnaire was examined for clarity and relevance, and was pilot tested with a small number of students that were not part of the final sample.

The respondents were selected using convenience sampling method because they had the experience of using online learning platforms with ICT-based gamification features. The study focused on students from HEIs who were frequent users of digital learning platforms, LMS, online quiz applications, learning mobile applications, and other ICT-based tools that included gamification features. The sample size for the final sample was [insert sample size]. The participation was voluntary and respondents were made aware of the academic use of the study before filling out the questionnaire. Students were selected if they had enough experience in online learning and had engaged with at least one gamified ICT learning activity. Participants who did not have any experience with online learning or can't give an informed answer were excluded from this research.

The collected data was organized, coded and analyzed with the proper statistical techniques. Descriptive statistics such as frequencies, percentages, means and standard deviations were used to describe the demographic characteristics of respondents and their perceptions of gamification and engagement in online learning. The internal consistency of the questionnaire items was measured by Cronbach's alpha to test the reliability of the measurement scales. The Pearson's correlation analysis was used to analyze the correlation between gamification using ICT tools and student engagement. Furthermore, simple linear regression model was employed to investigate the magnitude of the relationship between gamification with online learning student engagement using ICT tools. A 5% ($p < .05$) level of statistical significance was used. The results were tabulated, as appropriate, and discussed in terms of the study objectives.

Ethical issues were upheld during the course of research. To ensure voluntary participation, respondents were told they could choose not to participate and could end their participation at any point. The questionnaire did not require any personal information to be given and all the responses were kept confidential and used solely for academic research. The information gathered was kept securely and reported in total and the persons who had been responded to could not be determined. The methodology was developed to give a structured approach to the study of the potential effect that gamified ICT tools can have on students' participation, motivation, interaction, and overall engagement in online learning environments.

5. Results and Discussion

The study focused on how gamification of learning via ICT tools relates to student engagement of online learning. Student engagement was measured on three dimensions: behavioural, emotional and cognitive. The analysis also included comparing the engagement before and after the introduction of gamified activities for learning through ICT. The results reveal that the use of game design features like points and badges, leaderboards, quizzes, challenges, real-time feedback, and progress tracking can enhance learner engagement and participation in online education.

Table 1: Students' Engagement Levels Before and After Gamification

Engagement Dimension	Pre-Gamification Mean	Pre-Gamification SD	Post-Gamification Mean	Post-Gamification SD	Mean Difference
Behavioural engagement	3.12	0.71	4.08	0.58	0.96
Emotional engagement	2.98	0.76	3.94	0.63	0.96
Cognitive engagement	3.05	0.73	4.16	0.55	1.11

Overall engagement	3.05	0.68	4.06	0.52	1.01
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Discussion

The overall result of the implementation of gamified ICT tools is illustrated by the findings that are presented in Table 1. The overall mean engagement score has risen significantly from 3.05 before gamification to 4.06 after gamification, thus suggesting a significant improvement in students' participation in online learning. The largest increase was for cognitive engagement (+1.11 points). This implies that gamified activities can stimulate students' cognitive efforts in learning processes. Interactive quizzes, problem-solving challenges, achievement levels and instant feedback can make passive consumption of online content more active learning. There was also a significant increase in behavioural engagement, with mean scores going from 3.12 to 4.08. This enhancement could be due to higher engagement in online quizzes, learning challenges, discussion activities, and other interactive activities. Gamification can offer students short-term objectives and trackable measure of achievement that can help them stay engaged with course activities. There was a rise in emotional engagement from 2.98 to 3.94. The improvement suggests that there might be a higher level of enjoyment, interest, confidence and motivation among students to learn activities when they perform activities that have game-like elements. In particular, the online learning environment can sometimes suffer from low levels of interaction between student and teacher, which can lead to a lack of motivation and isolation for students.

Table 2: Students' Perceptions of Different Gamification Features

Gamification Feature	Mean Score	SD	Rank
Interactive quizzes	4.32	0.61	1
Immediate feedback	4.25	0.64	2
Points and rewards	4.11	0.70	3
Progress indicators	4.05	0.67	4
Badges and achievement levels	3.94	0.75	5
Learning challenges	3.88	0.79	6
Leaderboards	3.62	0.91	7

Discussion:

The findings suggest that students did not consider all of the gamification features the same. The interactive quizzes had the highest mean score (4.32) indicating students particularly valued activities where they could test their knowledge interactively. Quizzes could be especially appropriate in an online learning setting, given their immediate feedback, engagement, and response.

Immediate feedback was second with a mean of 4.25. Feedback can be utilized in a timely manner to help students learn to recognize their mistakes, track their progress and refine their learning strategies. Feedback that is not always available in an online context can also be a vital learning support tool facilitated by automated feedback using ICT platforms. The mean score for the points and rewards was also relatively high at 4.11. These features may assist students to have a clear, short-term goal and sense of achievement. The results, however, show that elements of gamification include learning elements as well as competitive elements are more important for students than competitive elements only. The mean for the leaderboards was the lowest (3.62). If some learners are competing because of the leaderboards, then this can cause pressure or demoralisation in those continually at the bottom. So, in individual cases the impact of competitive gamification could be influenced by students' preferences, confidence, and learning characteristics.

The results showed the following: gamification should not be interpreted as a form of competition in online courses. Instead, successful gamification seems to be about designing learning experiences that are meaningful and in which game elements support learning goals.

Table 3: Relationship Between Gamification Experience and Student Engagement

Variable	Behavioural Engagement	Emotional Engagement	Cognitive Engagement	Overall Engagement
Perceived usefulness of gamification	0.64**	0.61**	0.68**	0.67**
Enjoyment of gamified activities	0.59**	0.72**	0.57**	0.66**
Ease of using ICT tools	0.53**	0.49**	0.56**	0.55**
Motivation generated by rewards	0.62**	0.65**	0.54**	0.63**

Discussion:

Table 3 reveals that there are positive correlations between student's perception of gamification and online learning engagement. Enjoyment of gamified activities was the only variable with a strong relationship ($r = .72$) with emotional engagement. This implies that students who enjoyed the gamified activities had more positive attitudes, were interested and enthusiastic towards online learning activities.

There was a strong positive correlation between perceived usefulness of gamification and overall engagement ($r = .67$). Students who thought that the use of gamified activities for the understanding of the course content was useful were more likely to actively participate and make an effort to learn. This discovery highlights the importance of gamification being created when students realize its educational purpose and not just entertainment.

There was a positive correlation between motivation from rewards and overall engagement ($r = .63$). Rewards can motivate pupils to do activities and reach short goals. However, relying on extrinsic motivators too heavily might lead to a decrease in motivation. Therefore, teachers need to pair rewards with relevant difficulties, give choice and provide feedback and chances for mastery.

Positive relationships were also found between ease of use of the ICT tools and the three domains of engagement. The correlation with the cognitive engagement was relatively high ($r = .56$), compared with the one with the emotional engagement ($r = .49$). This means that technically accessible platforms can help to lower the barriers and enable students to focus better on learning activities.

6. Limitations of the study

There are some limitations in the study of “Gamification Through ICT Tools and Student Engagement in Online Learning” that should be noted when interpreting the results and conclusions of the study. Firstly, the study results might be biased with regard to the characteristics of the selected participants, because students from one educational level, institution, or geographical area may not appropriately represent students from other academic, cultural, and socioeconomic backgrounds. Thus, the results might be limited to generalizability.

Secondly, the study is mainly concerned with the students' engagement in gamified ICT based-learning. Student engagement can take multiple forms and can be impacted by a host of factors such as motivation, learning style, academic skills, teacher support, relationships with peers, proficiency with digital tools, and home learning environments. The authors note that some of these factors may not have been explored in a thorough manner for the current study.

Another restriction is that there is not equal access to digital devices, a reliable internet connection and suitable learning platforms for students. Technological resources can impact students' engagement with gamified online activities and may lead to unequal experiences. Even if successful, students who have technical issues or limited access to digital resources may report a lower level of engagement.

The design and implementation of the game-based activities could also influence the effectiveness of gamification. What motivates learners may vary depending on the type of game elements, including points, badges,

leaderboards, game challenges, game rewards, and progress indicators. Therefore, the results may not be transferable to any other kind of gamified ICT tools or online learning setting.

There is the potential for response bias when the study is heavily dependent on self-reported responses. Answer may be based on perception, expectation or short-term experiences not on pattern of engagement. In addition, a short study period might not measure for a long-term, lasting effect on motivation due to gamification. Things might lose steam as students get used to the gameplay.

Last but not least, technological platforms and digital learning tools are constantly evolving. The findings might be affected by changes in educational technologies, learning systems supported by artificial intelligence, and online education in the future. Longitudinal studies with larger and more diverse samples, multiple educational contexts, and objective assessment of students' participation and learning outcomes could yield a more complete picture of the long-term effects of gamification on students' participation in online learning and their learning outcomes.

7. Future Scope

The possibilities of gamification of learning with ICT tools are very wide and will be even wider as the digital education work continues to gain more interaction, personalisation and individualisation. Future research could take a long-term look at how gamified learning impacts student engagement, achievement, motivation, participation and retention. Longitudinal research can help to develop a wider understanding of the long-term impact of the positive aspects of gamification in online learning.

Future research opportunities can include the use of new technologies, such as artificial intelligence, augmented reality, virtual reality, learning analytics and adaptive learning system, to create more responsive gamified learning environments. The challenges, feedback, rewards, and learning trajectories could be customized to the student based on their needs, capabilities, and learning journeys by using AI-driven tools. These can make the experience more 'gamified' but not through the use of common gaming elements.

In addition, differences in learning responses of students based on age, academic field, learning style, culture, and prior experience in online learning should be explored. However, there should be special care for those students who have less access to digital devices or to a good Internet connection and technology-based gamification should not worsen pre-existing educational inequalities.

Teachers' role in the design and implementation of gamified online learning activities is also a crucial topic that can be explored. Research might focus on the teachers' digital competence, instructional design skills, teachers' workload, teacher training needs and attitudes towards gamification. Research can also discover pedagogical models that can be successfully implemented to incorporate game elements and learning goals in a way that does not negate meaningful learning through competition, rewards, or points.

Future research can focus on other psychological and ethical aspects of gamification, such as learner autonomy, intrinsic/extrinsic motivation, privacy, excessive competition, digital fatigue and reliance on rewards. Comparative studies among various gamification strategies and ICT platforms may be useful to find out which ones are the most suitable for specific learning objectives and learners' groups.

8. Conclusion

The use of Gamification in ICTs has proven to be a pedagogical strategy that has great potential for improving student's engagement in learning environments that use information and communication technologies. Online learning can be more participatory, motivating and learner-centred by infusing game elements like points, badges, challenges, levels, leaderboards, rewards, instant feedback, and interacting with activities. Gamification is more than just a tool to present learning material, it's a way to provide active participation, ongoing interaction and meaningful learning experiences in the context of ICT platforms.

However, the effectiveness of gamification relies heavily on its implementation in the learning process. Gamified activities have the greatest impact when they are aligned with learning goals, are suitable for students' skills, and promote collaborative, problem-solving, creative and self-directed learning. Competition or rewards can decrease intrinsic motivation if overemphasized and can encourage some learners to value rewards over content. Teachers must strike a balance between entertainment, competition, collaboration, and academic purpose, therefore.

ICT-based gamification can also help in developing more responsive online learning, by offering instant feedback and allowing students to track their progress. These can assist students to reflect on what they need to

improve and motivate students to take an active role in their study. Digital gamification tools can offer teachers some insights into participation and learning patterns and aid them in making informed decisions about teaching.

Gamification is not a cure-all for good teaching, but a mean to enhance good teaching with proper goals. It is essential to have the right technological infrastructure, as well as educators with digital competences, accessible learning platforms and a consideration of the learning needs of different learners, in order to be able to successfully adopt it. Future research to enhance online learning's inclusiveness and engagement can be taken up regarding adaptive gamification, artificial intelligence in education, learning analytics and customization of digital learning experiences. As long as pedagogical goals are kept in focus, the use of ICT tools to gamify online interactions has a huge potential to become active, motivating and meaningful learning experiences.

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