



# The Impact Of Gamified Learning Platform On Student Achievement And Engagement In Higher Education

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**Abstract:** The aim of the research was to determine how gamified learning platforms impact the academic performance of college students (i.e. performance) and their participation in a college environment compared to traditional online environments. An approach of mixed methods was taken in which data was collected within a time span of 12 weeks on 50 undergraduate students pursuing Management and Computer Science courses. The group of students who took part in this study was divided into the Experimental group or Control Group. In the case of the Experimental Group, the gamified platforms employed at this time were Kahoot! Quizizz, Duolingo, and Classcraft. In the Control Group, non-gamified platforms that were used at this time were Google Classroom and Moodle. The quantitative findings have shown that Experimental Group scored significantly higher on an average post-test result as compared to Control Group (Experimental: 18.4 pts; Control: 10.3 pts). The Experimental Group had much greater indices of student engagement in the areas of student attendance, activity completion and activity participation as compared to Control Group. The Experimental Group did not lose their drive throughout the 12 weeks and they only experienced a slight decline in engagement. In the Control Group, the participation reduced significantly during the study. This study could be useful in finding the usefulness of gamified methodology within the framework of traditional, full-time degree program courses in an education environment that is quickly transforming due to digitization.

**Keywords:** e-learning, gamified, non-gamified, gamification, education, kahoot!, Quizizz, Duolingo, Classcraft, platforms, teachers, technologies.

## I. INTRODUCTION

The use of gamification, i.e., the introduction of the concepts of points, badges, challenges, and leaderboards in the context of non-games, has gained popularity in the sphere of higher education due to the rapid emergence of digital technology. As a motivational theory supported by such theories as Self-Determination Theory (SDT), gamification aims to enhance competence, autonomy, and engagement among students. As per the recent studies, it is possible to integrate tools such as Kahoot! The transition of Moodle, and Classcraft into e-learning affects motivation, involvement, academic performance, and retention in a favourable way (Dominguez et al., 2013; Li et al., 2023) [1]. Nevertheless, the outcomes remain inconclusive, with part of the literature showing only short- term or minimal improvement depending on the characteristics of learners, setting, and the quality of designs (Hanus & Fox, 2015) [2]. The broader tendencies, long-term effects, and the principles of ideal design of gamified learning in higher education are not distinct despite the growing popularity thereof. Theoretical alignment, sustainability and cross-disciplinary outcomes are gap areas as most of the existing research is narrow or tool based. These contradictions highlight the fact that a systematic evaluation of the implementation of gamification, the most effective elements of it, and the conditions under which it contributes to substantial academic advantages should be conducted. To gain a more comprehensive picture of the role, benefits and challenges of gamification in the e-learning process on the university level, the ongoing review tries to synthesize studies published since 2013 [3].

The modern children lack the ability to maintain attention because of constant digital stimulation but they are highly engaged in interactive games which give them instant feedback. The old model of lecturing cannot be used anymore because higher education shifts towards emerging stronger competencies such as critical thinking, teamwork, and problem-solving (Deslauriers et al., 2011; Freeman et al., 2014) [4], [5]. Gamification is following these new requirements because, by providing dynamic, learner-focused, and motivating experiences that enhance engagement and understanding, it enhances learning and comprehension (Han-Huei Tsaya et al., 2018; Goksuna and Gursoy, 2019) [3], [6]. The fact that educators still have divergent opinions despite the evidence mostly indicating the success of gamified e-learning in higher education makes it the reason why comprehensive research is necessary to understand the best practices and the maximum potential of this method.

### 1.1 The Study's Background

The tendency towards technology-enhanced learning in higher education has been growing over the recent years, which opens up the possibilities of more participatory and student-centred instruction methods. Gamified learning has received considerable attention due to its integration of learning content with game elements such as points, badges, leader boards, challenges and awards [7]. These are the features designed to increase motivation, keep interest, and promote active learning, which the traditional e-learning resources often lack. Considering that modern students are digital natives, gamified platforms will support their favourite learning style and offer a more engaging alternative to traditional web-based tasks. Specifically, it is not yet clear what exactly gamification does to student performance and how it differs according to the subject, technology, and learning environment. Due to this, there is need to sufficiently look into the impact of gamified platforms to participation, engagement, understanding and overall academic performance in tertiary education institutions. The need to explore the learning effectiveness of the programs such as Kahoot! Quizizz, and Classcraft are identified by the growing popularity.[8]

### 1.2 Problem Description

Although the use of gamified learning platforms has become increasingly popular in the context of higher education, there is very little information on their effectiveness in terms of improving student performance and learning outcomes. The gamification is mostly welcomed in many universities by the virtue of its apparent attractiveness and appeal yet they lack the hard data on the academic advantages of gamification. Gamified tasks can be fun to students, and it does not guarantee a greater understanding and long-term retention of the information. Also, type of content, manner in which the content is delivered and background of the learners can influence the effectiveness of gamification [9]. It is still uncertain whether gamified alternatives can truly solve this issue or offer temporary stimulation as the conventional e-learning methods often are not enough to maintain student motivation. Due to this fact, educators struggle to understand whether gamification is something that should be used as an additional tool or as a serious component of the course development. This study addresses the gap by exploring the issue of gamified learning on student engagement and educational achievement.

### 1.3 Importance of the Research

This report is of great value to teachers, schools and lawmakers seeking innovative methods to enhance learning. Gamification can completely transform conventional teaching processes by making the learning process more interesting, entertaining and student-centred. When the institutions are aware of the efficacy of gamified technologies, they will be in a better position to determine whether to include it in their curriculum [2]. The findings can assist educators to develop more captivating learning plans that enhance student performance, motivation and engagement. Well-developed gamified systems can help generate a better understanding, retention, and engagement in classroom activities, which directly help students. Gamified learning has a growing impact on the academic literature by providing tangible evidence of the effects of gamified learning on educational performance at the higher education level where research is still at its early stages.

## II. LITERATURE REVIEW

The last decade has offered an exponentially increasing number of studies on the topic of gamified learning in the context of higher education with a more frequent utilization of digital technologies by teachers to enhance student motivation and learning outcomes [10]. The gamification intellectual basis was elaborated with the help of the early foundational works such as that of Deterding et al. (2011) [11] who explained that gamification is the use of game design elements not in a game setting to enhance the motivation of the user. Based on this framework, (Zichermann and Cunningham (2011)) [12] have presented how challenges, progress tracking, and reward systems that make use of mechanics can positively influence the learner behaviour and persistence. The effects of gamified e-learning systems on student outcomes have been evaluated in several empirical studies. During a comprehensive examination, (Dichev and Dicheva (2017)) [13] have found that although gamification always increases the engagement among the students, its intervention on academic achievements varies with learner motivation and course structure. Their findings underline the importance of the alignment of learning goals with gaming. Similarly, Hamari, Koivisto and Sarsa (2014) [13] in their meta-analysis of the gamification literature revealed that most of the education applications in the learning context yielded good motivational effects, but the effectiveness of these applications is influenced by context, field, and the quality of implementation. Gamified platforms in use such as Kahoot! Quizizz, and Classcraft have been widely researched in the higher education setting. Wang (2015) [14] indicates that Kahoot! enhances the short-term learning outcomes, increasing the participation of the students and creating a competitive but fun classroom environment. Moreover, Bawa (2019) [20] revealed that the application of Quizizz in college courses led to the increased levels of student satisfaction and increased rating in terms of formative evaluation. Also, gamification enhanced the theoretical knowledge and incentive of students to complete learning tasks during computer science and management classes, as reported by Lopez and Tucker (2019) [7]. Other scholars have focused on the psychological impact of specific game elements. Nah et al. (2019) [16] explain that reward systems, leaderboards, and badges significantly enhance the cognitive engagement of students and encourage them to be more engaged in the classroom activities. Sailer et al. (2017) [17] note that social elements such as leaderboards and team competition stimulated peer-to-peer involvement and teamwork, but achievement aspects such as points and badges were linked to increased intrinsic motivation. Recent studies also focus on the integration of gamification in the e-learning settings. Huang and Hew (2018) found that gamified online learning modules raised the level of student accountability and completion of higher education courses. More recently, Dominguez et al. (2020) examined the setting of a blended learning and found that gamification positively affected the ability to memorize information among students due to the opportunity to revise all information at their own pace and get instant feedback. Moreover, observed that gamified mobile learning tools such as Duolingo tremendously enhanced the vocabularies acquisition and perseverance of university students. It is important to note that although the outcomes of gamification are encouraging, it is not always effective. Seaborn and Fels (2015) [18] affirm that precise instructional design, student tastes, and relevancy to curriculum objectives are the keys to the effectiveness of gamification. The newness effect, the stress caused by competition, and the unequal participation of students are also suggested as potential challenges in some studies. IN general, the content under publication suggests that gamized learning platforms hold much potential in increasing student motivation, engagement, and academic success in higher education. The differences in the results between fields, however, point to the need to conduct the context-specific research further. As the objective exploration of the effects of gamified learning aids on student achievement through the use of real data collected on

undergraduate students pursuing degrees in management and computer science, this research contributes to the literature of the current knowledge.

### III. RESEARCH GAP

Although gamified learning platforms have been widely researched in higher learning, they still have some notable gaps. Very little studies have sought the direct relationship between gamification and measurable academic achievement in real classroom activities; most of the current research focuses on student engagement or motivation. The applications of the results in other fields are difficult to generalize as most of the previous research was based on a small sample, short-term experiments, or used a single platform. Also, most of the studies fail to compare gamified learning platforms to the traditional e-learning platforms, which restrict our information on the extent to which gamification can be considered a real improvement over popular digital learning tools, such as Google Classroom or Moodle. Furthermore, previous studies tend to state theoretical benefits of gamification but offer few empirical data gathered among the representatives of various groups of students. The gap in understanding of the specific effects of various elements of the game (e.g., points, badges, leaderboards, instant feedback) on the learning performance and the attendance of classes also exists [15] [7]. Only a small number of studies present both quantitative and qualitative data in order to have a broad understanding of the actual experiences of students, their perceptions as well as the learning outcome. Hence, more in-depth, mixed-method studies are required to establish the actual usefulness of gamified learning platforms in student performance in post-secondary education, particularly in Indian academic environments where the implementation of digital learning is still on the increase. Based on initial results of our sample group, the exposure to gamified technologies was moderate (43.5% used Quizizz/Duolingo, 34.8% used Kahoot!), whereas traditional platforms were familiarized with greatly (91.3% used Zoom, 82.6% used Google Classroom). This experience gap shows the need to understand the impacts of gamification on pupils with varying degrees of previous exposure [8].

### IV. PROPOSED SOLUTION

To be able to assess the role of gamified learning platforms on student achievement in higher education comprehensively, the present research is based on a mixed-method research design, which combines quantitative and qualitative approaches. Where the qualitative part is devoted to the analysis of the student and teacher attitudes, the motivation, and engagement during the learning process, the quantitative one evaluates such tangible results of education as test scores and grades. The research aims to achieve statistical validation as well as an understanding of the contextualization of how gamified learning influences the behaviour and academic performance of the learners by combining the two approaches.

#### 4.1 Design of Research

The research is conducted in a mixed-methods manner to provide an in-depth evaluation of the impact of gamification in higher education. Before and after implementing gamified learning platforms, the levels of academic performance and engagement are quantified as the scope of the quantitative aspect. Meanwhile, the qualitative element captures the personal opinions and views of teachers and students, their life stories. Since it offers the contextual richness of qualitative analysis and empirical accuracy of quantitative data, such a method is ideal in the cases of education-related research, as it will provide the holistic appreciation of outcomes and experiences.

#### 4.2 Participants

The project includes about 50 undergraduate students, enrolled in two universities, in computer science/business courses. The participants are selected through the application of purposive sampling that ensures that the participants who are familiar with digital or blended learning environments are not left out. The two categories of participants are Gamified learning tools such as Kahoot! The experimental group will include the coursework of Quizizz, Duolingo, and Classcraft. Control Group (Traditional E-learning) [7]. This group will receive the same course material with the use of non-gamified tools such as Moodle or Google Classroom. Each of the participants is explained the goals and the methods of the study, and participation is voluntary. In the course of the research, such ethical considerations as the informed consent, confidentiality, and free withdrawal are observed.

### 4.3 Tools and Instruments

The study uses several tools that ensure that there is a reliable and exhaustive data collection:

#### 4.3.1 Gamified Learning Platforms

Interactive activities, quizzes, and gradual challenges are designed based on such platforms as Kahoot! Quizizz, and Classcraft to involve the students and encourage collaboration and rivalry.

#### 4.3.2 Academic Achievement Tests

A pre-test and post-test are used to evaluate the development and learning goals of the students. These tests are done before and during the intervention, and they are to assess information retention, conceptual comprehension, and problem-solving skills.

#### 4.3.3 Student involvement Questionnaire

Emotional, behavioural and cognitive involvement of participants are measured by means of standardized Likert scale survey adapted as Student Engagement Scale (Fredricks et al., 2004). [19]

#### 4.3.4 Observation Checklist

In order to allow real-time assessment of behaviour during the sessions, researchers adopt a structured checklist in which they note down the interactions in the classroom, the frequency of participation and the level of enthusiasm.

#### 4.3.5 Semi-Structured Interviews

The selected instructors and students will participate in the semi-structured interviews where they share their ideas about motivation, perceived benefits, challenges, and experiences with gamified learning in general.

#### 4.3.6 Baseline question Questionnaire

The frequency of use of the e-learning platform, previous experience in using e-learning platforms, curiosity in gamification-based learning, preferred gamification elements, and perceived motivation impact will all be documented in this comprehensive pre-study questionnaire. Through this, the establishment of baseline attitudes and the control of pre-existing biases are made possible.

### 4.4 Analysis of Data

In order to ensure that the findings are fairly interpreted, the analysis of the collected data is done using both quantitative and qualitative approaches.

#### 4.4.1 Quantitative Analysis

The pre-test and post-test outcomes of the experimental and control groups are statistically analysed with the help of t-tests like paired sample t-tests and ANOVA. Descriptive statistics (mean, SD) has been used to describe the level of engagement scores although correlation research is used to test the relationship among academic performance and the level of involvement.

#### 4.4.2 Qualitative Analysis

The thematic analysis of the transcripts of interviews assists in determining the general patterns and themes that refer to motivation, involvement, and educational experiences. It is also true that triangulation of conclusions that is based on the information gained out of classroom observations elevates the validity and reliability of the interpretations [15].

To identify the relationship between previous experience with the platform and subsequent learning or the level of engagement following the correction of the familiarity effects, preliminary analysis is performed to learners.

### 4.5 Moral Aspects

The study is done in full compliance with the ethics research standards. The informed consent is obtained by all the participants, and they are explained their right to withdraw at any point. The data anonymization protects their identity. The Institutional Research Ethics Committee initially approves the research protocol that provides that the study is objective, honest and does not intrude on the privacy of the subjects.

### 4.6 Anticipated Results

It would be seen that the students receiving learning tools based on gamification would fare far much better in school than their peers who studied in a conventional e-learning facility based on the research. Gamification will be anticipated to increase participation, motivation, and engagement that will result in active involvement and interest in learning. Moreover, the qualitative feedback will also reflect the favorable attitude towards digital gamified tools indicated by their significance in rendering the process of higher education more interesting and engaging. Overall, it may be assumed that the results would give the empirical evidence of gamification as an efficient pedagogical intervention and a beneficial addition to the existing education systems.

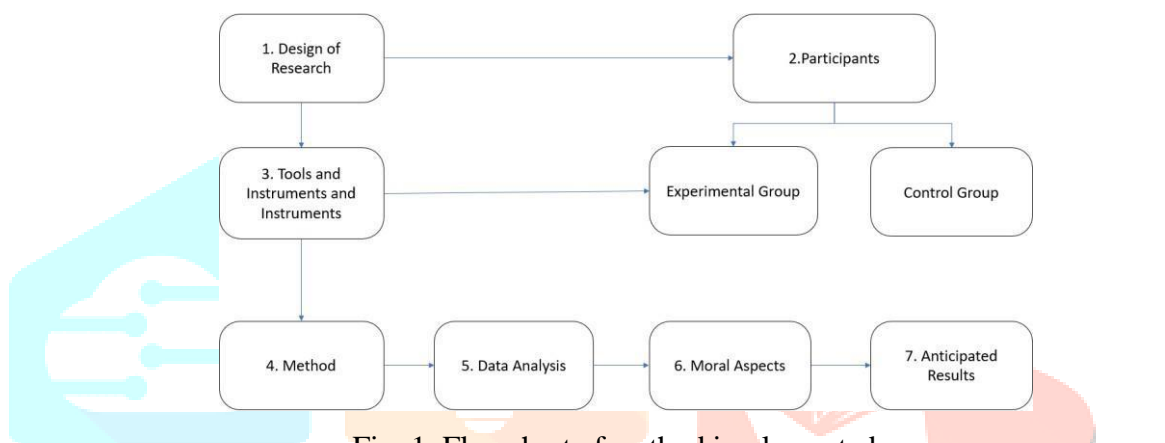


Fig. 1. Flowchart of method implemented

### 4.7 Baseline Survey Result

A baseline survey was administered to participants prior to the intervention to discover information about their attitudes regarding gamification, familiarity with the platform, and existing e-learning behaviours. The findings of the survey help to account the bias or the level of experience that is pre-existing and provide essential background information to explain the findings of the study.

Table 1 includes a summary regarding the numbers employed to describe the results of the baseline survey, including the participants application to e-learning platforms, experience and interest of the game-based learning, the feature of gamification that they prefer most, and the perceived impact of gamification.

Figure 2	Figure 3	Figure 4	Figure 5	Figure 6
Use of E-learning Platforms	Experience with E-learning Platforms	Interest In Game Based Learning Platforms	Preferred Gamification Features	Effect of Gamification

Table. 1. Description of figures related to Baseline Survey Results

### 4.8 Frequency of Use of E-learning Platform

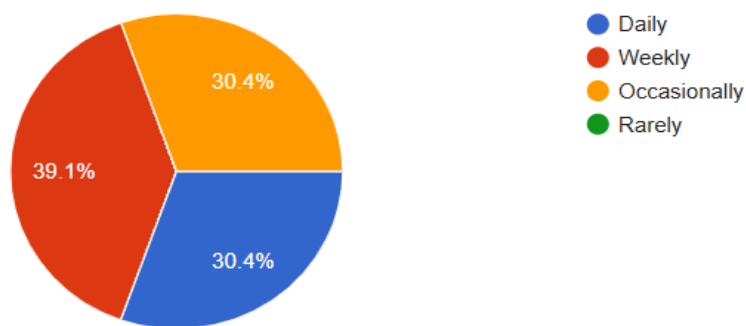


Fig. 2. Frequency of E-Learning Platform Usage

Fig 2 presents the consistency in the use of digital learning resources by the participants. Most of them state that they utilize e-learning sites weekly (39.1%) or irregularly (30.4) with 30.4% indicating that they used it every single day. Interestingly, no one mentioned that s/he rarely used these platforms, which means that the sample consists of digitally engaged students who feel comfortable in online learning environments.

### 4.9 Previous Experience with E-learning Platforms

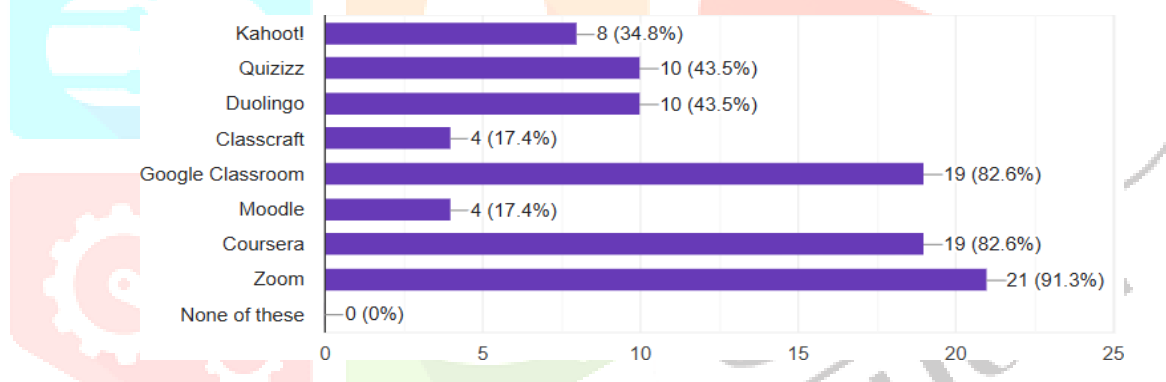


Fig.3. Prior E-Learning Platform Usage Among Participants

The participants had extensive experience with traditional technologies such as Zoom (91.3%), Google Classroom (82.6%), and Coursera (82.6%), which explains why they are highly familiar with them (Figure 3). The mediocre exposure to gamified platforms was observed; 43.5% of the respondents were using Quizizz and Duolingo, and 34.8% were using Kahoot!. The use of such specialized game-based platforms like Classcraft (17.4%) and Moodle (17.4%), were lower in use. This dispersion shows that, even though the subjects are not new to the traditional- based e-learning, most of them are not well-acquainted with the fully gamified space, which makes them a good target to evaluate the impact of gamification.

#### 4.10 Interest in Learning Through Games

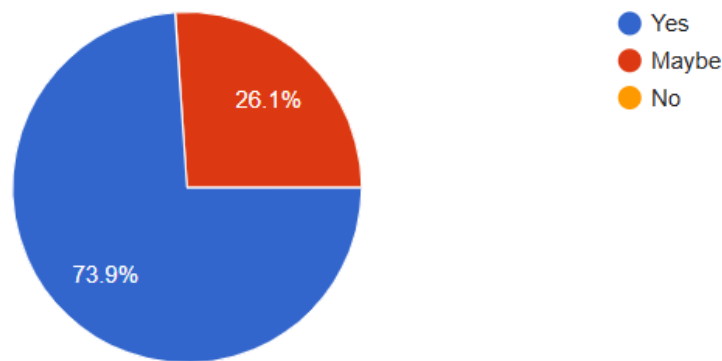


Fig. 4. Interest In Game Based Learning Platforms

A majority of the respondents (73.9 percent) responded affirmatively (Yes) on whether they would be interested in using game-based learning platforms, with 26.1 percent responding (Maybe) (Figure 4). Importantly, none of the participants responded with No, which meant that the sample was rather favourably oriented to gamification. Such a level of interest shows that there are not many motivational barriers to adopting this program among the target population and conditions are the best to test gamified therapies.

#### 4.11 Favourite Gamification Elements

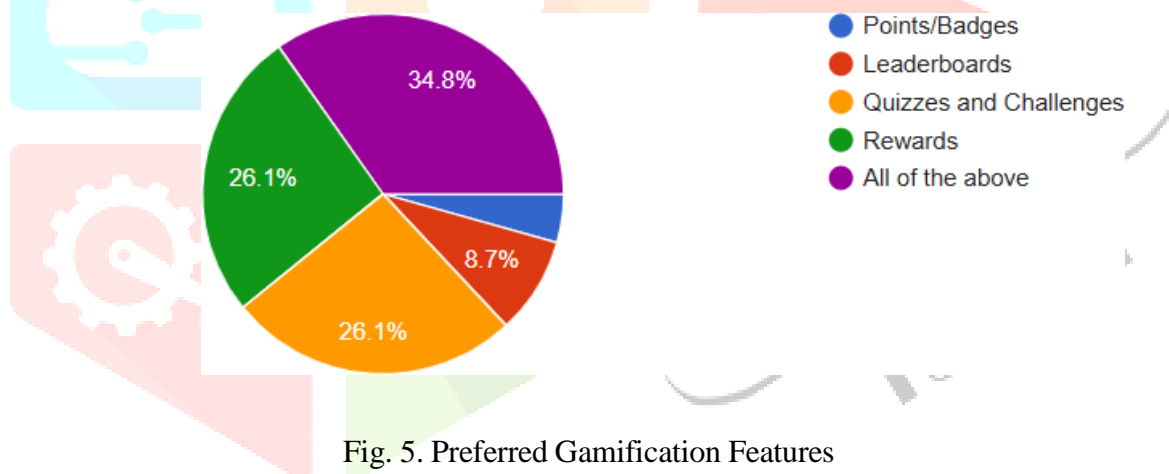


Fig. 5. Preferred Gamification Features

The participants were told to specify what interests them the most regarding gamification (Figure 5). The results showed that there were different preferences:

**"All of the above"** was favoured by **34.8%** of respondents, suggesting a preference for several traits.

Both **"Quizzes"** and **Challenges** and **"Rewards"** were favoured by **26.1%** of respondents.

**"Leaderboards"** were selected by **8.7%**.

**"Points/Badges"** were preferred by **4.3%**.

These findings suggest that successful gamified sites must have more than one element. Competitive rankings are not the only things that are sought after by students because they prefer quizzes, challenges, and incentives very much.

#### V. RESULT AND FINDINGS

The results of the study that include the results of academic performance, engagement indicators, students perspectives, and the effectiveness of specific gamification features are provided based on the purpose of

the research. The data were collected among 50 undergraduate students who studied management and computer science courses in a 12-week intervention period.

### 5.1 Comparison of Pre-test and Post-test

Between the pre-test and the post-test, the experimental and the control groups demonstrated improved performances in academics; nevertheless, the level of change was significantly different across the groups. The experimental group, having a pre-test score of 58.4 (SD = 12.3) and a post-test score of 76.8 (SD = 10.5), employed the gamified learning systems such as Kahoot, Quizizz, and Classcraft--improved by 18.4 on average. The control group, which learnt through traditional e-learning tools (such as Google Classroom and Moodle), scored a smaller improvement of 10.3 points with a mean pre-test score of 57.9 (SD = 11.8) and an post-test score of 68.2 (SD = 12.1). Statistically, the improvement in both groups was significant, as statistical analysis by paired sample t-tests (experimental group:  $t(24) = 8.42, p < 0.001$ ; control group:  $t(24) = 4.15, p < 0.05$ ) showed. An independent samples t-test has shown that experimental group post scores were significantly higher than control group scores ( $t(48) = 3.21, p < 0.01$ ) with a medium-large effect size (Cohens  $d = 0.76$ ). These results show that, as compared to traditional e-learning techniques, gamified learning platforms significantly increased academic attainment.

### 5.2 Key Findings and Synopsis

To sum up, the results indicate that gamified learning environments outperformed traditional e-learning environments significantly in several aspects. The students in the experimental group had higher academic performance, greater engagement during the semester, more pleasure, and greater preferences regarding continuous use of gamified tools. The synergistic effect of combining a number of gamification elements appeared to enhance the overall learning experience although some of the elements, including quizzes and instant feedback, were found to be the most effective. These findings provide solid empirical data in support of the use of gamification in the higher education setting.

## VI. CONCLUSION

In a digital age, wherein pedagogical practices are rapidly altering as a result of digital change, the present study was aimed at assessing the effect of gamified learning platforms on student achievement in higher education. This paper has compared the effectiveness of gamified systems such as Kahoot! Quizizz, and Classcraft as compared to conventional e-learning systems such as Google Classroom and Moodle with a 12-week intervention study with a rigorous mixed-method approach that used a sample of 50 undergraduate students of computer science and management careers.

The results clearly show that the gamified learning sites are effective in improving the academic performance, student engagement, and long-term motivational support than the traditional e-learning platforms. Students who were in the experimental group recorded an average 18.4 points improvement in the post-test performance which is a 78 percent more improvement than that of the control group (10.3 points). This colossal opposition, which is supported by statistical research and massive effect size (Cohen  $d = 0.76$ ), is a good indication that gamification works go further than the surface entertainment to produce measurable results of learning. Gamification influenced the motivational and behavioural factors of learning other than academic success. During the semester, the experimental group- possessed attendance percent of 92.3 and activity completion percentage of 88.5 and the result in percentages was significantly superior to the control group, which was 78.6 and 71.2, respectively. The most notable it was discovered that gamified platforms which had maintained interest lost to a maximum of 3.5% in student interaction within the 12 weeks term of the study, unlike the conventional e-learning systems which were lost 14.2%. With such exemplary consistency, the issue of online education sustenance is one of the most enduring student concentration in the time frames of many hours without face-to-face interactions.

This study empirically supports a number of significant claims that have been made about gamified learning in higher education settings. First, it shows that gamification is an educational innovation that is more than just a pedagogical buzzword or superficial solution because it can lead to significant and measurable improvements in student performance. The 18.4-point increase in performance is a significant academic growth factor that could lead to higher grades on courses, improved retention of basic knowledge, and improved preparation to take higher courses or work as a professional.

Second, the research study reveals that the benefits of gamification extend beyond the initial novelty impacts. Over time, objections have been raised whether game-based learning only leads to short-term bursts of student activity that can be quickly extinguished as they become used to new instructional forms. This concern is proven to be false and gamification proves to be possible even in case of semester-long or even year-long applications as the academic results remain the same during the intervention course, and the high involvement has been observed during the 12 weeks.

Third, this paper shows that successful gamification requires meticulous combination of multiple elements rather than the unthoughtful inclusion of single features. The most effective designs combine both extrinsic and intrinsically motivating factors such as mastery progression, autonomy and meaningful challenge as indicated by the significant relationship between instant feedback and performance ( $r = 0.58$ ) and the smaller effect of badges alone. Such conclusion would pose a serious implication on the instructional designers that should not succumb to the temptation of simply putting points and badges on already developed material without subjecting it to prior pedagogical scrutiny.

Fourth, the research proves that gamification benefits can be easily applied across multiple educational environments. The absence of significant performance difference between management and computer science students suggests that the principles of gamification, namely, feedback loops, engagement scaffolding, and motivating design, cut across subject-specific information.

In addition to its immediate implications on education, this study is a part of the larger discourse on the future of higher education in a world that is turning more digital, global, and fast moving. As we all know, the traditional lecture-based, passive modes of learning are not sufficient in developing critical thinking, flexibility, teamwork, and self-directed learning skills necessary in the modern job and civic involvement. Gamification is one of the possible methods that can be used in the quest to achieve the goal of providing students with various active learning techniques that portray them as active learners, not passive receivers of knowledge. Another concern in growing worries on the motivation, mental well-being, and sense of belonging of college students is also discussed in the study. The feeling of progress, achievement, and belonging that gamified learning platforms can foster can address the ever-increasing cases of loneliness, inadequacy, and detachment that students are increasingly reporting in online and hybrid learning environments. The research further provides that learning innovation does not require curriculum reform or a great deal of financial investment. The platforms discussed within the frames of the present study can be integrated into the existing courses without substituting the key information and are free or cheap.

## VII. FUTURE SCOPE

The paper is informative concerning the impact of gamified learning on higher education, yet it also brings to light numerous issues and gaps that require further investigation. This section presents possible areas of future research that may further the understanding of gamification, overcome the existing limitations and how gamification can be further used in the education field.

### 7.1 New Platform and Technological Innovation

The rapid advancement of digital technology also presents exciting opportunities to the next-generation gamification studies comprising the innovative features that do not exist on the current platforms. Artificial intelligence and machine learning systems are necessary to make adaptive gamification possible, where learning experiences are personalized in real-time depending on their individual performance trends, engagement indicators, types of errors and learning preferences. Further studies should explore whether AI-based platforms that adjust the difficulty of challenges in real-time, provide more elaborate explanatory feedback in forms other than indicators of correct/incorrect, leverage behavioural analytics to detect frustration or confusion and tailor the presentation of content accordingly, and whether these AI-based platforms predict the optimal time to reward individual learners outperform more basic gamification designs. Immersive learning experiences provided with the help of virtual reality and augmented reality technologies allow students to work with three-dimensional simulations, control virtual objects, and practice skills in safe and realistic conditions. Specifically, in subjects that require spatial knowledge, procedural knowledge or more complicated systems dynamics, studies comparing VR/AR gamified learning with conventional screen-based gamification might demonstrate whether immersive bodily experiences lead to improved transfer of skills to the real-world, greater conceptual comprehension, or

enhanced retention of knowledge. The blockchain technology opens the prospects of decentralized credentials system where students can create portable skill portfolios, which are recognized by employers and other educational organizations through accruing verifiable digital badges and micro-credentials that indicate some competencies. Research on whether blockchain-based gamified learning ecosystems enhance the transition between education and employment, whether it is possible to facilitate individualized learning pathways unlimited by traditional course designs, or whether it enhances motivation by increasing meaningful real-world credible value would inform this new application. Mobile-first design is another critical area of study as the students are becoming the primary users of smartphones and tablets as their primary computing devices. Studies should determine whether mobile gamification levels the playing field by providing access to students who lack laptops and whether gamification adapted to smaller screens, touch interfaces, shorter interaction periods suitable to commuting or breaks and offline functionality when promised areas of poor connectivity need alternative design principles than those needed by desktop-based platforms. In addition, research on how gamification can be applied to social media platforms and professional networks like LinkedIn and informal online learning communities can also reveal how the mechanisms of games that continue beyond formal courses to everyday digital spaces can lead to cultures of lifelong learning that reinforce and supplement classroom learning. It is by critically analyzing these new technologies that researchers can place education in a strategic position so that they can make good use of the latest and booming platforms, whilst they can establish the potential dangers, accessibility, and design principles that will truly make innovations enhance the learning process and not merely to add more complexity in technology [7].

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