Gamification as Online Teaching Strategy: Case Study from Various Subjects

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Abstract. The Covid-19 pandemic has caused a significant transformation in the field of education, necessitating a rapid and extensive shift to online instructional methods. This study investigates the application of gamification as a potent approach for augmenting involvement, motivation, and educational achievements in the online learning landscape. Leveraging insights from previous research and practical insights, this article delves into the fundamental principles of gamification, its advantages within the realm of online education, and provides practical recommendations for its effective implementation. Through the presentation of successful instances and recommended practices, we illustrate how gamification can address the challenges of remote learning, ensuring both the continuity of education and the establishment of an engaging and interactive virtual classroom.

Keywords: Education, online teaching, gamification, learning strategy.

1 Introduction

The Covid-19 pandemic has speeded up the adoption of online education worldwide. Educational institutions, educators, and students have had to adapt rapidly to the challenges of remote learning. There has been a critical need to develop educational tools that align with social distancing measures. With millions of students constrained by these measures to curb the epidemic's spread, the swift transition to distance education has become a widespread approach [1]. This shift toward remote learning has been made feasible by ongoing advancements in digital technologies, enabling online interactions [2]. While technology offers students greater access to information and fosters knowledge creation and sharing, it also places a demand on educators to find ways to bolster student motivation and engagement. Consequently, substantial efforts have been dedicated to devising new teaching strategies aimed at enhancing student motivation, commitment, and knowledge acquisition [3, 4]. Among the various strategies explored, gamification has garnered the attention of educators in recent times for its potential to enhance student learning [5, 6]. Studies investigating the effectiveness of gamification have shown promising, albeit varying, results [5, 6, 7, 8].

While the term "game" can be somewhat ambiguous, it's worth noting that researchers and educators have explored various game formats [9]. However, we can define gamification as the incorporation of elements typically found in games into non-entertainment contexts, primarily to facilitate learning. Games possess elements that naturally appeal to both young and adult learners, making them a potent tool for enhancing motivation in the learning process. Lately, there has been an increasing utilization of gamification within educational environments, with the goal of enhancing student motivation and promoting social engagement. As a result, games have been implemented in various educational levels, demonstrating their capacity to enhance learning results [6, 10]. This reciprocal connection between gaming and learning is reinforced by the continuous advancement of effective strategies in course gamification and game design. Typically, these games or courses are structured to progressively introduce and master new concepts. Students are then challenged with applying these concepts to progressively intricate challenges and, ultimately, utilizing their previous knowledge in new scenarios [11]. Furthermore, the incorporation of game elements into education serves multiple purposes. It has been reported to facilitate social connections [12], stimulate a quest for knowledge [13], nurture creativity [14], enhance mental well-being [15], and reduce feelings of isolation [16].

Hence, as per the principles of goal-setting and flow theories, educators should not only focus on creating applications that can boost student motivation but also take into account the unique challenges that students encounter during periods of confinement. As a result, gamification can function as a valuable instrument to alleviate the physical and psychological limitations linked to quarantine situations. It's important to recognize that some students do not possess advanced technology or reliable internet connections in their homes, which limits the broad utilization of gamification in online learning environments. This limitation has been particularly evident during the Covid-19 pandemic, especially in less developed regions and rural areas.

The primary objective of this research is to assess the documented experiences of implementing gamified learning in higher education settings during the Covid-19 pandemic. Our examination will encompass a detailed exploration of the gamification strategies employed, the methodologies applied amid the pandemic, and the resulting impacts on motivation and educational outcomes. Additionally, we intend to delve into the theoretical foundations underpinning these gamification approaches and their role in enhancing the physical and psychological well-being of students.

The study has the following structure: first, a review of the gamification in section two. Section three discusses the implementation of gamification in various subjects. Section four presents the analysis of the results obtained, discussion and confrontation with the literature. Finally, the section five expresses the conclusions, practical implications, limitations and research related to the subject under study.

2 Gamification

Gamification involves the incorporation of elements commonly found in games, such as competition, challenges, rewards, and feedback, into non-game environments like

education. Gamification in online education can yield numerous benefits for learners. These include heightened motivation and engagement, improved learning outcomes, and the provision of personalized, adaptable learning experiences. It achieves this by leveraging both intrinsic and extrinsic motivators, offering goals, challenges, rewards, and constructive feedback. Gamification fosters a more enjoyable, interactive, and communal learning atmosphere by infusing elements of play, competition, and collaboration. Furthermore, it contributes to better retention, transfer, and practical application of knowledge and skills by supplying immediate and relevant feedback. Learners also gain the flexibility to tailor their learning experience according to their pace, proficiency level, and chosen learning path through various options, levels, and play modes. Importantly, gamification can be fine-tuned to align with learners' performance, preferences, and individual requirements, delivering targeted feedback, guidance, and support.

Various forms of games and gamification approaches are available. One straightforward method involves the use of quizzes, offering students the opportunity to assess their knowledge through different platforms, including web-based quizzes and applications. In recent times, educators have created various electronic quiz apps to support students in different fields of study. Moreover, they have applied various gamification strategies, including challenge-oriented, immersion-focused, and social-based gamification. The challenge-oriented approach revolves around overcoming obstacles [5, 6]. The immersion-based model seeks to immerse users in a narrative, characterized by its audiovisual richness [17]. Finally, games with a social focus facilitate the cultivation of competitive and cooperative tactics [18].

Gamification plays a crucial role in promoting active learning, a fact supported by global studies demonstrating its effectiveness in increasing student engagement. This approach extends across various domains, including business, government, healthcare, and education. Gamification employs elements commonly associated with games within non-gaming contexts to enhance motivation, encompassing both intrinsic and extrinsic aspects. Extrinsic motivation often arises from reward systems, while challenges tend to stimulate intrinsic motivation. Consequently, the incorporation of game elements and experiences into various learning methodologies defines the practice of gamification. Additionally, gamification fosters the development of cross-cutting skills and attitudes, including collaboration, self-regulated learning, and creativity [4, 7]. In gamified learning, rules, emotions, and social roles become integral parts of the learning experience, constituting essential elements of the educational process.

3 Implementation of Gamification in Various Subjects

While earlier investigations have delved into the incorporation of online tools and games within the realm of education, the application of gamification strategies has not been extensively explored in previous studies. Conversely, a substantial portion of the literature predominantly concerns research proposals, protocols, and expert viewpoints regarding the adoption of digital tools within educational environments. The rapid onset of the COVID-19 crisis posed significant challenges in planning and

executing empirical studies to assess the effectiveness of gamified tools. In response, the majority of educators found themselves expending considerable efforts to transition from traditional face-to-face classrooms to online instruction using video conferencing tools.

This section presents real-world examples and case studies of successful gamification implementations in online education. It highlights instances where gamification has significantly improved student engagement, motivation, and learning outcomes.

3.1 Gamification for Chemistry

Chemistry crossword puzzles have a history of usage, and their utility as a learning tool during the COVID-19 pandemic has been acknowledged. Pearson (2020) employed crossword puzzles as a means of facilitating remote active learning for pharmacy students in their first and second years of undergraduate study [19]. These crossword puzzles, centered around chemistry themes, were made accessible through the eBlackboard platform and served as supplementary resources to enhance the content covered in lectures and problem-solving exercises.

Among the subjects within Organic Chemistry, organic reactions are often regarded as one of the most challenging. Prior research indicates that integrating game-based learning activities with chemistry concepts in the classroom tends to elevate student motivation [20], leading to enhanced academic performance [21, 22]. This approach also fosters greater student engagement compared to conventional teaching methods.

In a study by da Silva et al., they created an interactive game-based application called "Interactions 500" with the intention of assisting students in collaborative review of concepts related to intermolecular forces [23]. Originally, this game was designed for in-classroom use; however, the shift to remote learning became necessary due to the interruption caused by the COVID-19 pandemic.

Similarly, Fontana created a gamified activity based on a software application designed for drawing molecules, which goes by the name ChemDraw [24]. The primary goal was to provide students with practical experience in using this tool, and they were engaged in a tournament-style competition as part of this activity.

3.2 Gamification for Computer Education

Programming language is one of the important course in computer education. Krause and his team conducted an experiment where they explored the application of gamification and social components in an online Python course for teaching students. This educational approach was aimed at addressing several common challenges associated with online learning, including feelings of isolation, low motivation, and a lack of interactivity. The researchers divided students into three separate groups: one group underwent conventional education, the second group participated in gamification, and the third group engaged in gamification paired with social gaming components.

Concerning gamification, various game elements like accomplishments or badges, points, and leaderboards were fused. In the social gaming context, a competitive element was introduced, enabling students to partake in challenges against each other. The results of this approach displayed a noteworthy extension in the retention period, with a substantial 25% boost, and a remarkable 50% increase in the retention period when social game components were incorporated, in contrast to a 40% rise in average test scores [25].

Marnıa-Blanca employed gamification as an instructional strategy when teaching the C programming language in order to assess its impact on both learning outcomes and student engagement. This research followed a mixed-method sequential explanatory protocol. A gamification framework was designed to facilitate students in posing questions and gaining proficiency in topics related to the C programming language, employing fundamental game mechanics.

The findings revealed that a significant number of students continued to actively participate even after achieving the maximum possible grade points. Their motivation persisted as they aimed to accumulate all available badges and to further their learning. The author concluded that gamification proved to be effective, with student engagement serving as a valuable indicator of their academic accomplishments [26].

Moreover, there are many application for computer education, for example for database normalization [27], software engineering [28]

3.3 Gamification for Business Simulation

Enterprise Resource Planning (ERP) systems are intricate solutions that encompass and integrate various functions within an organization, including finance, HR, procurement, and production. They serve as a central hub for information and facilitate cross-functional business processes throughout the entire company [29]. These systems can be daunting for newcomers to navigate, and even experienced users may face challenges, especially when dealing with cloud-based ERPs, which frequently undergo software updates that can alter navigation and functionality [30]. In their study, Pakinee and Puritat explored the impact of employing gamified and non-gamified approaches in an Enterprise Resource Planning (ERP) course [31]. The objective was to enhance student motivation and foster active participation, especially in a remote working from home setting.

Customer Relationship Management (CRM) involves managing interactions with both prospective and existing customers with the objective of ensuring their satisfaction and happiness. There are limited articles available concerning the intersection of Gamification and CRM, primarily focusing on assessing the interest in gamified CRM systems and strategies for introducing such systems within organizations [32, 33].

While it may not be immediately apparent how to apply Gamification in CRM systems, as is the case with ERP systems (typically for training) and Knowledge Management Systems (typically to enhance user participation), some studies have explored the implementation of gamification techniques in various CRM-related scenarios.

4 Analysis and Discussion

To effectively employ gamification as an online teaching strategy, educators can follow these practical guidelines: (1) Define clear learning objectives: Clearly outline the educational goals and outcomes to align gamified elements with the curriculum. (2) Select appropriate game mechanics: Choose game elements that best suit the subject matter and learning objectives, such as leaderboards, quizzes, or storytelling. (3) Generate a narrative or setting that offers a captivating story or context, adding significance and intent to the gamified tasks. (4) Provide immediate feedback: Offer timely feedback to students on their progress and performance to keep them engaged and informed. (5) Use a variety of tools and applications: Explore different gamification tools and platforms that suit the online teaching environment, such as learning management systems, educational apps, or dedicated gamification software.

Gamification techniques offered a subtle way to observe the advancement of students in their learning journey, which encompassed tracking their interactions on the online platform and their achievements within the gaming environment. Other approaches to gauge students' perception of their own advancement involved the utilization of surveys and interviews. However, some research endeavored to assess students' learning based on their exam performance. In general, the research we examined employed a blend of quantitative and mixed methodologies to assess students' learning and involvement. In the majority of instances, the studies we assessed found that gamification had a beneficial influence on learning results. At times, this statement relied on subjective impressions from participants gathered through surveys, whereas in other cases, studies conducted objective tests to assess students' knowledge. However, no concrete evidence suggests that gamification yields superior learning outcomes compared to more traditional approaches. Additionally, game elements associated with competition led to mixed responses among students and didn't have the same impact on everyone; in some instances, they could either boost or diminish motivation depending on the individual's personality.

5 Conclusion

The COVID-19 pandemic has necessitated innovative approaches to online teaching, and gamification has emerged as a powerful strategy to maintain student engagement, motivation, and learning outcomes. Numerous research endeavors have concentrated primarily on utilizing Gamification for training and education. However, there exist unexplored avenues for the application of Gamification strategies in various contexts. It's important to emphasize that this field of research is relatively nascent, and significant untapped potential remains.

By implementing the principles and guidelines outlined in this paper, educators can harness the potential of gamification to create dynamic and interactive online learning experiences that bridge the gap created by the pandemic, ensuring educational continuity and success.

While gamification offers numerous advantages, educators must be aware of potential challenges, such as designing effective game mechanics, ensuring

accessibility, and addressing individual differences in student preferences and abilities.

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