Review

A Review of Gamification Research in Online Education

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Abstract: Currently, gamification has increasingly garnered extensive attention from both academic circles and industrial sectors due to its inherent advantages in fostering user immersion, enhancing engagement, and cultivating long-term loyalty. Within the specialized field of pedagogy, gamified learning represents the strategic integration of these ludic elements into educational frameworks. Although the scholarly investigation of gamified learning spans a significant historical trajectory, a comprehensive and nuanced understanding of the underlying "game chemistry" within the specific context of online education remains insufficient at this stage. Consequently, this paper first provides a systemic synthesis of the current landscape regarding online education platforms both domestically and internationally, while clarifying the formal definition of gamification and tracing its developmental evolution. Furthermore, the existing body of research concerning gamification in online education is categorized into three distinct dimensions for a rigorous and detailed discussion: the mechanical relationship between specific gamification elements and measurable learning outcomes, empirical practices that explore the multifaceted effects of gamified interventions, and targeted research focusing on the diverse application scenarios of gamification. Finally, this paper summarizes the core research contributions within the domain of online education gamification and offers a forward-looking prospect on future developmental trajectories and potential research frontiers in the digital era.

Keywords: online education; gamified learning; review and evaluation

Published: 27 December 2025

1. Introduction

1.1. Development and Challenges of Online Education

With the profound integration of advanced digital technologies-including high-performance computing, the Internet of Things, cloud computing, big data analytics, and artificial intelligence-into the pedagogical sphere, the online education environment has successfully transcended the spatial and temporal constraints inherent in traditional classroom settings [1]. This technological convergence has propelled educational informatization into an entirely new phase, characterized by a developmental trajectory toward intelligence, ubiquity, personalization, openness, and cross-disciplinary collaboration. Prominent online education platforms, such as Zhongguo Daxue MOOC, Xuetangx, Coursera, and edX, have revolutionized the accessibility of high-quality educational resources [2]. These platforms empower learners to engage with academic content from prestigious institutions regardless of their geographical location, thereby significantly accelerating the globalization of digital learning [3]. As shown in Figure 1, the 2021 Class Central report indicates that, excluding specific regions, approximately 950 universities worldwide offered a cumulative total of 19,400 massive open online courses [4].

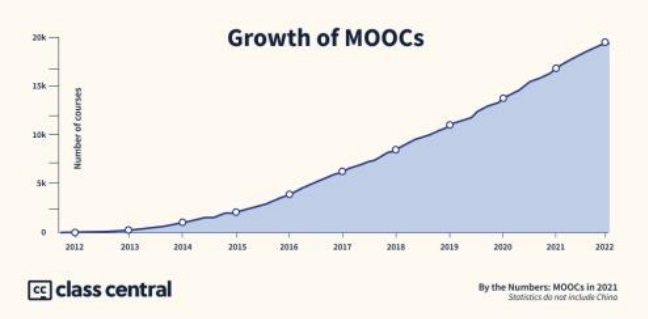

Figure 1. The trend of MOOCs course numbers in 2021.

Despite the innovations in learning models brought about by its inherent informatization and cross-temporal characteristics, online education faces substantial hurdles [5]. Compared to traditional face-to-face instruction, the large-scale open learning model is consistently plagued by a high dropout rate and significant difficulty in maintaining course completion standards. Research findings in literature suggest that between 40% and 80% of online learners fail to complete their registered courses. This data reveals that the retention rate in online education remains approximately 10% to 20% lower than that observed in traditional pedagogical methods [6]. Consequently, identifying effective mechanisms to bolster the participation rates, completion rates, and intrinsic learning motivation of online learners has emerged as a critical and widely debated issue in contemporary educational research [7,8].

Gamification is defined as the strategic integration of game design elements and mechanics into non-game contexts to enhance user engagement, concentration, and long-term retention. This concept has been extensively adopted across various domains, including business management, industrial training, and healthcare, with the education sector serving as a primary pioneer in gamification exploration. Practical scholarly attention toward the pedagogical potential of games can be traced back to the 1980s. Recent investigations into large-scale online teaching during periods of restricted physical movement demonstrate that gamification can effectively stimulate learning motivation and active participation [9]. These findings underscore the urgent necessity to innovate online teaching theories to better suit the digital habits of modern learners.

The present study systematically organizes and synthesizes existing research regarding the gamification of online learning. This comprehensive exposition categorizes relevant academic work into three primary dimensions: first, an exploration of the fundamental relationship between specific gamification elements and measurable learning outcomes; second, an analysis of specific design practices aimed at enhancing learner participation through gamified structures; and third, an investigation into the broader application research concerning gamified online learning environments.

2. The Current Situation of Online Education Platforms

2.1. Foreign Online Education Platforms

Massive Open Online Courses (MOOCs) represent a transformative and open online education model that permits learners to register freely for various academic disciplines. Since the landmark year of 2012, this model has rapidly evolved into a mainstream form of education across the globe. Within this burgeoning field, Udacity, Coursera, and edX have emerged as the three most representative and influential platforms, each maintaining unique operational philosophies and structural designs.

1) Udacity: Operates primarily as a profit-oriented platform with a specialized focus on professional skill development and the mastery of cutting-edge technologies. A defining feature of this platform is its structured pedagogical approach, wherein it architecturally plans a clear and progressive learning path

for students based on the inherent difficulty level of the subject matter. This systematic guidance helps learners bridge the gap between theoretical knowledge and industrial application.

2) Coursera: Established in 2012 by professors from Stanford University, this platform emphasizes the power of community interaction and data-driven intelligent recommendations. For instance, it provides a robust feedback ecosystem by displaying comprehensive course evaluations. Furthermore, it leverages algorithms to recommend relevant secondary courses to users based on shared interests and historical learning behaviors, thereby fostering a collaborative digital learning environment.
3) edX: Functioning as a high-profile non-profit platform jointly founded by Harvard University and the Massachusetts Institute of Technology, it is globally renowned for hosting top-tier, up-to-date academic content. The platform distinguishes itself by providing highly personalized course search services that align with the specific interest directions of learners, ensuring that users can access rigorous scholarly resources from the world's leading research institutions.

Beyond these three primary pillars, the international landscape is enriched by various other mature educational platforms. These include Khan Academy, which focuses on foundational knowledge, as well as national MOOC platforms that possess distinct regional characteristics, such as Future Learn in the United Kingdom and Open2Study in Australia. Together, these entities form a diversified global network of digital knowledge dissemination.

2.2. Domestic Online Education Platforms

The rapid ascent of the MOOC sector within China is rooted in a significant consensus reached by the domestic education community: the strategic necessity of independently developing localized platforms and systematically accumulating educational big data. Driven by this imperative for digital sovereignty and educational quality, several representative domestic platforms have implemented innovative practices:

1) Xuetangx: This platform focuses on optimizing the user experience by proactively recommending high-quality, high-demand, and national first-class courses. By leveraging a curated selection process, it assists learners in navigating the vast amount of available data to efficiently identify and screen for the most authoritative educational materials.
2) Zhongguo Daxue MOOC: Heavily integrated with the "Undergraduate Teaching Quality and Teaching Reform Project," this platform serves as a central hub for higher education resources. Its sophisticated recommendation logic effectively combines temporal relevance-highlighting the latest and most popular courses within a given week-with thematic relevance, which suggests supplementary courses closely aligned with a learner's current field of study.
3) NetEase Yun Ketang: Recognized as one of the earliest platforms dedicated to practical and vocational technology courses, its core functionality centers on career-oriented growth. It provides highly targeted course recommendations based on the specific professional directions and skill sets chosen by learners, facilitating a direct link between online study and workplace competency.

3. The Definition of Gamification

In 2011, gamification was formally defined as the strategic utilization of game design elements within non-game contexts to stimulate and sustain user engagement [10]. This definition underscores the transition of game mechanics from purely recreational environments to functional domains. The theoretical foundation of gamified learning is

deeply rooted in the evolution of early educational games, serious games, and the broader framework of game-based learning. These pedagogical approaches share a common goal: leveraging the intrinsic motivational power of play to facilitate knowledge acquisition and skill development.

In 2001, a visionary perspective was proposed regarding the integration of video games into the instructional process [11]. It was argued that such an application could significantly bolster the appeal of educational content to students. This perspective particularly emphasized the unique value of gamified approaches for the generation often referred to as digital natives-individuals who have been immersed in digital technology from an early age and possess a natural affinity for interactive, media-rich environments. For these learners, traditional passive instruction often fails to compete with the high levels of feedback and agency found in digital interfaces.

Scholars and practitioners typically identify three primary modes for achieving effective game-based learning. The first mode involves utilizing existing commercial video games by identifying and extracting the educational value inherent within their narratives or mechanics. The second mode focuses on the design and implementation of serious games or specialized educational games. Unlike commercial entertainment products, serious games are developed with the primary objective of fostering learning and training, rather than providing leisure [12]. Their development process is characterized by a rigorous alignment between game mechanics and specific pedagogical outcomes. The third mode encourages students to independently design and develop their own games. This constructive approach is intended to enhance their higher-order cognitive skills, including problem-solving, logical programming, and creative game design capabilities.

Gamification elements serve as the fundamental building blocks of any gamified system, functioning much like a comprehensive toolbox where each specific element represents a distinct tool for psychological or behavioral intervention. Among the diverse array of mechanics available to designers, the three most ubiquitous and influential gamification elements are Points, Badges, and Leaderboards. Frequently abbreviated as PBL in academic literature, these elements constitute a core framework for providing feedback, establishing status, and fostering a sense of progression within the learning environment [13].

4. Research Status

4.1. The Relationship between Gamification Elements and Learning Outcomes

Research within this specific domain primarily focuses on the causal mechanisms and incentive effects that gamified learning methodologies exert on academic performance and student development. Given that the academic community has yet to reach a definitive consensus regarding the precise influence mechanisms of gamification on learning outcomes, specialized meta-analyses have been conducted to provide quantitative clarity. For instance, a rigorous meta-analysis involving 18 highly correlated studies and a dataset of 2,983 subjects concluded that gamified online education yields a significant positive impact on learning outcomes [14]. Similarly, another comprehensive meta-analysis evaluated 35 experimental reports from both domestic and international sources, employing a multidimensional coding system that included variables such as publication year, sample size, disciplinary classification, educational stage, and knowledge type [15]. This quantitative approach facilitated an objective assessment of how gamification affects students across various subjects and cognitive levels.

Beyond meta-analysis, empirical investigations have explored the qualitative and subjective dimensions of learner motivation. One study utilized a two-part investigative framework to assess how gamification drives engagement in online courses [16]. The first phase required students to evaluate their motivation across a five-level Likert scale, while the second phase utilized open-ended queries to identify the perceived benefits and

drawbacks of implementing gamification in a digital environment. Furthermore, practical research has focused on the integration of gamified evaluation systems, such as Kahoot and Quizizz, into synchronized online teaching [17]. These systems facilitate real-time, competitive assessments that transform traditional after-class quizzes into immersive experiences. A systemic review of the literature further confirms that gamification elements positively influence not only cognitive learning but also emotional variables, such as student satisfaction and academic self-efficacy, across diverse implementation techniques and subject areas [18].

4.2. Explore the Specific Practices of Gamification Effects

While the preceding section establishes the theoretical and empirical foundation for the incentive effects of gamification, this section focuses on the specific pedagogical practices and design frameworks utilized in online educational settings. Research in this area translates psychological theories into actionable instructional strategies. For example, by synthesizing the ARCS (Attention, Relevance, Confidence, Satisfaction) motivation model with Self-Determination Theory (SDT), researchers have developed frameworks to analyze student performance through a combination of quantitative data collection and qualitative course reflections [19]. This approach allows for a more granular understanding of how specific design choices correlate with learner persistence.

In the context of instructional design, five core principles for gamified online teaching have been proposed: the goal-oriented principle, the flexible principle, the interesting principle, the individualized principle, and the process-oriented principle [20]. These principles serve as a guide for optimizing the digital teaching process-specifically within the domain of elementary Chinese language online courses-by structuring intervention strategies across three key dimensions: pre-class preparation, teaching process design, and evaluation feedback. Additionally, research has aimed to bridge the gap between gamification and instructional design for large-scale open courses [21]. This involves aligning gamified course interfaces with specific course elements to support complex language learning, thereby providing a theoretical and practical framework that enhances the connectivity and accessibility of diverse online resources.

4.3. Application Research on Gamification

This branch of research focuses on the deployment and optimization of gamification design across diverse academic disciplines and institutional management systems. The application of these elements is not limited to general education but extends to highly specialized technical fields. For instance, game design elements such as points, leaderboards, and collaborative team-forming mechanics have been integrated into the online experimental teaching of Financial Econometrics [22]. This integration serves to optimize the experimental teaching mode by simulating realistic competitive environments that are conducive to mastering complex economic models and data analysis.

Furthermore, in response to the administrative and pedagogical challenges emerging from the rapid expansion of online education in higher education institutions, new institutional mechanisms have been proposed [23]. These frameworks often consist of a tripartite structure: a platform community mechanism to foster social belonging, an incentive mechanism to maintain momentum, and a data-driven mechanism to monitor and adjust the learning trajectory in real-time. By applying such multi-layered gamification strategies, universities can better address issues related to student isolation and the lack of structured management in decentralized digital learning environments.

5. Conclusions

Gamification, characterized by its significant advantages in enhancing user engagement, cognitive concentration, and emotional immersion, has emerged as a pivotal

strategic framework for driving innovation across various sectors, including modern education, public health, and corporate business management. As scholarly research within this domain continues to deepen, it has provided substantial theoretical guidance and practical reference value for the systemic development of gamified learning environments. By transforming traditional, passive interaction models into dynamic and achievement-oriented experiences, gamification facilitates a more proactive approach to knowledge acquisition and behavioral change in the digital age.

Currently, the game elements most frequently deployed in these environments primarily consist of extrinsic reward mechanisms. These include structural components such as progressive levels, quantitative points, achievement badges, competitive leaderboards, and virtual currencies. This reliance on reward-based mechanics is particularly prevalent in the current stage of gamified learning development. However, the fundamental reason why the efficacy of gamification is increasingly being scrutinized by the academic community involves the psychological transition between different types of motivation. Although extrinsic reward systems can effectively stimulate an immediate surge in user enthusiasm and enhance platform activity in the short term, they may inadvertently undermine a user's intrinsic motivation over a prolonged duration.

Psychological research suggests that an over-reliance on external incentives can lead to a phenomenon where the learner becomes dependent on the reward rather than the learning process itself. Consequently, if these rewards are discontinued or lose their perceived value, the level of engagement may decline significantly, potentially resulting in a state of motivation that is lower than that observed in non-gamified environments. Therefore, the implementation of gamified learning should not be viewed as a static or universal solution. Ensuring its long-term effectiveness requires continuous longitudinal tracking research, rigorous data analysis of user behavior, and targeted iterative improvements to balance extrinsic incentives with the cultivation of autonomous, intrinsic interest.

Acknowledgments: We sincerely thank the research team of the Vocational Education Center. We would like to express our gratitude to the leaders and colleagues of the Vocational Education Technology Service Center. To much gratitude to National University of Defense Technology.

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