

Enhancing Academic Success through Gamified E-Learning: Evidence from Higher Education Students in Ganzhou, China

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Abstract

The rapid integration of technology in education has transformed traditional learning environments, particularly in higher education. In Ganzhou, China, gamified e-learning systems have emerged as innovative tools aimed at enhancing student engagement, motivation, and academic achievement. This study investigates the impact of gamified e-learning systems on the academic performance of college students in Ganzhou. The research adopted a quantitative approach, utilizing a structured questionnaire distributed to 399 college students selected through stratified random sampling. The study's objectives were to examine the relationship between gamified e-learning adoption, student engagement, student motivation, technological literacy, and academic achievement. The findings revealed a strong positive relationship between the adoption of gamified e-learning systems and academic achievement. The Pearson correlation coefficient of 0.843 indicated that students who engaged with gamified e-learning platforms demonstrated significantly better academic performance. Moreover, regression analysis confirmed that student engagement and motivation within gamified environments played critical roles in influencing academic outcomes. Motivation emerged as the most significant predictor, highlighting its essential role in driving academic success. Technological literacy was also found to have a substantial impact on students' academic performance, emphasizing the importance of digital proficiency in the modern educational landscape. The study is underpinned by Self-Determination Theory (SDT) and the Technology Acceptance Model (TAM), providing a theoretical framework to explain how intrinsic motivation and perceived ease of use influence learning outcomes in gamified systems. The results contribute valuable insights for educators, policymakers, and developers aiming to design effective gamified e-learning environments that foster student engagement and academic achievement. The study also recommends further research across diverse demographics and longitudinal studies to strengthen the generalizability of the findings. This research underscores the potential of gamified e-learning systems in enhancing educational quality and outcomes in higher education institutions in Ganzhou, China.

Keywords: Gamified E-learning, Academic Achievement, Student Engagement, Student Motivation, Technological Literacy

Introduction

The rapid development of digital learning environments has revolutionized education, particularly in higher education, where online learning platforms have become increasingly integral. In Ganzhou, China, known for its strong academic reputation, the integration of gamified e-learning systems presents both opportunities and challenges. While these systems are designed to enhance learning by incorporating interactive and game-based elements, their impact on students' academic performance remains unclear. There is limited empirical evidence exploring how such systems influence learning outcomes in this context, making it essential to investigate this issue further (Wu et al., 2022).

One of the key challenges in this area is understanding the effectiveness of these systems in enhancing academic outcomes. The diversity of student experiences in Ganzhou, including differences in participation, learning attitudes, and external influences, complicates efforts to measure the success of these systems. It is critical to examine how students interact with gamified learning environments and how those interactions translate into measurable academic achievements (Attard et al., 2021).

Students' learning experiences are influenced by their emotional and behavioral involvement in educational activities. Emotional responses to learning activities, such as interest, excitement, or frustration, play a vital role in shaping their willingness to engage with content. Similarly, behavioral aspects, including active participation and the effort invested in learning, significantly impact the overall learning experience. It remains unclear how these factors are influenced by gamified systems and how they contribute to students' academic outcomes (Wong & Liem, 2022).

Motivation is another critical aspect that drives student performance in educational settings. In the context of gamified e-learning, motivation can be driven by external rewards, such as grades or recognition, as well as internal satisfaction derived from the learning process itself. However, the ability of these systems to maintain and enhance motivation over time, particularly in higher education, has not been adequately explored. Further research is needed to understand the role of motivation in shaping student outcomes within gamified learning environments (Mula-Falcón et al., 2022).

Access to and familiarity with digital tools is an additional factor that affects students' learning experiences. In Ganzhou, students' technological proficiency varies widely, which can influence their ability to navigate and benefit from gamified learning systems. While those who are more adept at using technology may achieve better results, students who struggle with digital tools may face barriers that negatively impact their academic performance. Understanding these differences is essential for creating effective learning environments that cater to all students (Sayed et al., 2023).

Despite the growing use of gamified learning systems in Ganzhou's higher education institutions, their impact on students' academic success remains understudied. By examining how these systems influence students' learning experiences and outcomes, this research

seeks to provide valuable insights for educators and policymakers. Addressing these gaps wcontributes to the development of more effective, inclusive educational strategies that support the academic success of students in Ganzhou (Lei & Liu, 2023). The specific objectives for study are as follow:

RO1: To examine the relationship between gamified e-learning adoption and academic achievement among college students in Ganzhou, China.

RO2: To investigate the level of student engagement in gamified e-learning on academic achievement among college students in Ganzhou, China.

RO3: To assess the impact of level of student motivation on academic achievement within gamified e-learning environments among college students in Ganzhou, China.

RO4: To explore the influence of level of technological literacy on academic achievement among college students in Ganzhou, China.

Literature Review

As a result of the government's push for education and the country's lightning-fast technology development, online education in China has grown substantially over the last 20 years. Various factors, including new policies, technological advancements, and shifting social demands, are propelling China's education system toward a more digital future (Mills et al., 2023). Online education in China has its roots in the early 2000s, when widespread internet access began to pave the way for a better-connected and more tech-savvy Chinese society. Since then, e-learning has grown in popularity, driven by the need for better, more adaptable, and accessible educational options.

Through its many regulations and strategic goals, the Chinese government has been instrumental in advancing online education. The significance of combining education with information technology was emphasized in the "National Long-term Education Reform and Development Plan (2010-2020)" as a means of updating the educational system. Building stronger online education platforms, creating more digital educational resources, and enhancing teachers' ICT (Information and Communication Technology) skills were all priorities in this plan. Following this, other plans, such as the "Education Informatization 2.0 Action Plan," have expanded upon these ideas with the goal of incorporating ICT into every aspect of schooling by the year 2022. These projects demonstrate the government's determination to use technology to improve the accessibility and quality of education.

One of the main reasons why e-learning has become so popular in China is the extensive network of internet cafes and universities. With internet penetration reaching over 70% of the population, China boasts the biggest number of internet users in the world. Thanks to the proliferation of smartphones and other digital devices, kids in both urban and rural locations now have access to online educational resources. Thanks to this connection, kids in underserved and rural areas can now have access to high-quality education that was previously out of reach. Students and teachers are able to communicate and share resources easily because to the widespread use of platforms like DingTalk and WeChat (Wang & Zhao, 2022).

Online education in China has also been greatly impacted by recent technological developments. New opportunities for tailored and adaptable learning have arisen with the

advent of cloud computing, big data, and artificial intelligence (AI). The use of artificial intelligence allows for the analysis of student learning patterns, the identification of strengths and weaknesses, and the provision of personalized learning experiences. Students are more likely to stay engaged and motivated with this level of customisation, which in turn improves their learning outcomes. With the use of big data analytics, teachers can better understand their students' strengths and areas for improvement in terms of both performance and learning habits. It is now much simpler to provide instructional material to a large number of users all at once thanks to cloud computing, which has enabled the scalable deployment of e-learning resources.

There has been a considerable increase in the use of online education in China since the COVID-19 outbreak. Because of the immediate need to stop the spread of the virus, millions of students were compelled to switch to online learning as soon as classes were dismissed. In an unprecedented way, the possibilities and difficulties of online education were laid bare by this abrupt change. On the one hand, it proved that online education could work, with platforms like DingTalk by Alibaba and Tencent Classroom seeing huge increases in user numbers. But it also brought attention to the fact that some people, especially those with lower incomes and those living in rural locations, had less access to technology and the internet than others. In response to these issues, both public and private organizations have increased their spending on digital infrastructure improvements and initiatives to guarantee that all students have equal access to online learning materials.

When it comes to e-learning solutions in China, private enterprises have been in the vanguard. software behemoths such as Baidu, Alibaba, and Tencent have poured a lot of money into educational software, building systems that facilitate all sorts of online courses. Among the many online education tools used by Alibaba during the epidemic was DingTalk, which allowed for features like live class broadcasting, assignment management, and real-time contact between instructors and students. Online course platforms and AI-driven tutoring systems have been developed as part of Tencent's educational ambitions (Yuan, 2024). These systems are designed to accommodate students of varying academic levels and interests. The private sector has played a crucial role in developing e-learning in China, and the participation of these enterprises highlights this.

A number of obstacles persist, even though e-learning has undergone extensive development and broad implementation. A major problem is the digital divide, which prevents everyone from having equal access to education. Rural regions frequently have poorer infrastructure and less resources, compared to urban areas, which have more advanced internet infrastructure and access to cutting-edge technology. Existing educational disparities may be worsened as a result of this disparity, which impacts students' capacity to engage in online learning. Furthermore, there is a large range in the quality of e-learning content; some platforms provide interesting, well-designed materials, while others may not adhere to solid pedagogical practices. If e-learning is to continue to thrive, it is essential that educational materials offered online be of high quality and useful.

The necessity for continuing education and training for educators is another major obstacle. For online education to be a success, educators must be well-versed in the use of various digital resources. Adapting to new technologies and teaching approaches can be a challenge

for many educators, especially those with more experience in the field (Núñez-Canal et al., 2022). If we want our educators to feel comfortable and capable teaching in an online setting, we must provide them with thorough training and continuous support. More reliance on formative assessment and digital tools to track student progress are two additional evaluation and assessment strategies that are required by the move to online learning.

The acceptance of online education in China is influenced by cultural factors as well. The more traditional views of education, which place an emphasis on classroom lectures and memorizing facts, may conflict with the more dynamic and student-focused methods of online education. The possibility of digital learning as an adjunct to more conventional approaches needs a mental shift on the part of both students and teachers if we are to break down these cultural obstacles. For e-learning programs to be successful in the long run, it is essential to promote a mindset of constant learning and adjustment.

The implementation of e-learning in China has experienced a substantial transition, particularly as a reaction to the COVID-19 pandemic. Since the 1990s, the Chinese government has established a high priority on the development of e-learning because it recognizes the potential of this method to improve the accessibility and quality of education. (Zawacki-Richter et al., 2020) This commitment has been demonstrable through a variety of efforts that have been undertaken with the intention of incorporating technology into educational systems.

The epidemic hastened the transition toward on-line education, which has forced educational institutions to quickly adjust their practices. The perceived usefulness and simplicity of use of online learning platforms were found to have a substantial influence on college students' acceptance of these platforms, according to a study that was conducted at COVID-19 and examined the adoption of e-learning systems by college students (Hu et al of 2022). Consequently, this highlights the significance of e-learning systems that are both user-friendly and successful in order to encourage widespread use.

China's e-learning ecosystem continues to face obstacles, despite the fact that technological improvements have been made. Mao and Lee (2024) conducted a comprehensive analysis of the online learning experiences of Chinese students and found that there are a number of problems that need to be addressed. These problems include inadequate infrastructure, a lack of technical assistance, and insufficient digital literacy among both students and educators. Finding solutions to these obstacles is absolutely necessary in order to ensure the successful implementation of e-learning programs.

Additionally, the significance that mental health plays in the adoption of e-learning has been investigated. According to research, students' intentions to participate with e-learning platforms can be severely impacted when they perceive that they are experiencing general anxiety. Students who were feeling higher levels of anxiety during the initial COVID-19 epidemic had a lower level of enthusiasm to participate in online learning, which suggests that mental health support is necessary for the successful adoption of e-learning (Hu et al., 2022).

China is another country where cultural influences play a role in the adoption of e-learning. It is possible that the acceptability of online learning modalities was hampered by the traditional emphasis placed on face-to-face instruction and pedagogy that is centered on the teacher. According to Zawacki-Richter et al.'s research from 2020, it is vital to make efforts to match e-learning tactics with cultural expectations and educational values in order to improve accepted practices and efficacy.

The China Quality Course program is one of the efforts that the Chinese government has launched with the intention of promoting high-quality educational resources that may be accessed online. This program promotes educational institutions to create and distribute open courseware, which in turn makes it easier for people all around the country to gain access to high-quality education. These kinds of endeavors demonstrate a dedication to utilizing technology for the purpose of advancing educational achievement (Wang & Zhao, 2020).

In spite of this, technological obstacles continue to be a major worry. There are a number of challenges that have been highlighted as obstacles to the successful implementation of e-learning, including restricted access to necessary equipment and difficulties in adapting to online platforms, according to studies. The elimination of these technological inequalities is absolutely necessary in order to achieve fair adoption of e-learning (Ray et al., 2022).

It is notable that there is a significant gap between the adoption of e-learning in urban in comparison to rural locations. The shift to online schooling is typically easier in urban areas because of the superior infrastructure and access to technology that is available in these areas. On the other hand, rural areas may be confronted with obstacles such as insufficient internet connectivity and restricted access to digital equipment, which might impede the adoption of e-learning (Mao & Lee, 2024).

The uptake of e-learning is significantly impacted by the assistance provided by institutions. Higher levels of engagement with e-learning platforms are observed at educational institutions that offer full training packages for both teachers and students, in addition to providing technical assistance. For successful adoption, it is vital for institutions to demonstrate a commitment to incorporating technology into their educational programs (Hu et al., 2022).

In addition, problems over quality assurance have arisen as a result of the rapid spread of online learning. It is a difficulty that educational institutions need to handle in order to guarantee that online courses do not fall short of educational standards and that they offer relevant learning experiences. The development of robust evaluation mechanisms and strategies for continual improvement are critical steps for the maintenance of quality in e-learning, according to Zawacki-Richter et al.'s research paper from 2020.

There are a number of elements that might influence student engagement in e-learning settings. Some of these aspects include the design of the course, the level of interactivity, and the availability of support services. According to research conducted by Mao and Lee (2024), interactive components and timely feedback play a significant role in improving student

satisfaction and learning outcomes in online environments. In light of this, the key to successful e-learning is the intelligent design of instructional materials.

Underpinning Theories

Two theoretical frameworks that hold significant relevance for the study on the impact of gamified e-learning systems on academic achievement among college students in Ganzhou, China, are Self-Determination Theory (SDT) and the Technology Acceptance Model (TAM). Self-Determination Theory (SDT) posits that individuals are inherently motivated to pursue activities that satisfy their basic psychological needs for autonomy, competence, and relatedness. According to SDT, intrinsic motivation arises when individuals engage in activities that fulfill these fundamental needs, leading to greater persistence, engagement, and satisfaction. In the context of gamified e-learning, SDT provides a theoretical lens through which to understand the mechanisms underlying the motivational impact of gamification on student learning and achievement.

The Technology Acceptance Model (TAM) offers another theoretical perspective on the adoption and use of technology, focusing on the factors that influence individuals' intentions to use and accept new technologies. TAM posits that perceived usefulness and perceived ease of use are key determinants of individuals' attitudes and behavioral intentions toward technology adoption. Perceived usefulness refers to the extent to which individuals believe that a particular technology will enhance their performance or productivity, while perceived ease of use refers to the degree to which individuals perceive a technology as easy to use and understand.

Conceptual Framework

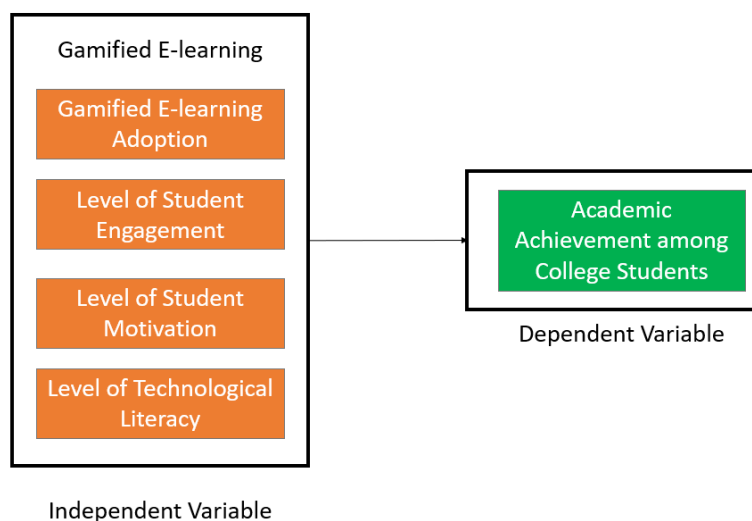


Figure 1: Conceptual Framework

Methodology

This study adopted a quantitative research approach to systematically analyze the impact of gamified e-learning systems on academic attainment. The choice of a quantitative methodology was guided by its ability to collect numerical data, facilitate the precise measurement of variables, and enable the establishment of statistical inferences about the relationships between those variables (Creswell & Creswell, 2023).

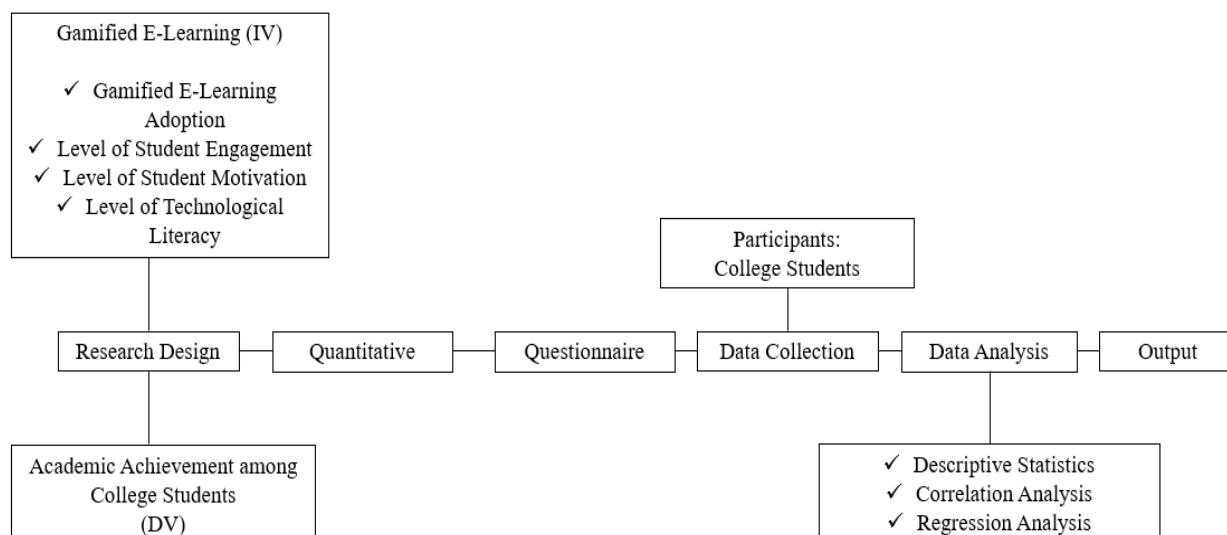


Figure 2: Research Design

This study was conducted in Ganzhou, a prefecture-level city located in the southern part of Jiangxi Province, China. Known for its rich cultural heritage and historical significance, Ganzhou is home to a diverse population and serves as an important educational hub in the region.



Figure 3: Location

The sample for this study is chosen using stratified random sampling, a method well-suited to ensuring that the diversity of the population is adequately represented. This approach is particularly appropriate given the size and heterogeneity of the target population—approximately 1.41 million college students in Ganzhou, China. The estimated sample size of 399 participants is calculated based on the formula by Krejcie and Morgan (1970), which provides a statistically robust method for determining sample size requirements for a given population. This formula ensures that the selected sample is large enough to produce reliable results while maintaining feasibility in terms of data collection and analysis.

The structured survey questionnaire was mainly distributed to the selected sample of Ganzhou college students to gather data for the study. To facilitate accessibility and participation, the poll was conducted electronically using various internet platforms. The survey results were carefully analyzed statistically to determine whether there is a correlation between college students in Ganzhou who utilize gamified e-learning systems and their academic performance.

Results

Hypothesis	Decision
H1: There is a significant positive relationship between gamified e-learning adoption and academic achievement among college students in Ganzhou, China.	Accepted
H2: Higher levels of student engagement in gamified e-learning are associated with higher academic achievement among college students in Ganzhou, China.	Accepted
H3: Increased level of student motivation within gamified e-learning environments leads to higher academic achievement among college students in Ganzhou, China.	Accepted
H4: A higher level of technological literacy positively influences academic achievement among college students in Ganzhou, China.	Accepted

The Pearson correlation coefficient of 0.843 indicates a strong positive relationship between gamified e-learning adoption and academic achievement. Additionally, the significance level (p -value = 0.000) confirms that this relationship is statistically significant. This suggests that students who engage in gamified e-learning perform better academically, likely due to increased motivation, interactivity, and engagement with educational content.

The regression analysis shows that student engagement in gamified e-learning significantly impacts academic achievement, with an unstandardized coefficient (B) of 0.746 and a standardized Beta of 0.611. The high t -value (15.398) and significant p -value (0.000) further confirm that student engagement positively influences academic performance. This implies that interactive learning environments encourage students to participate actively, leading to better academic outcomes.

The relationship between student motivation and academic achievement is highly significant, as shown by the unstandardized coefficient ($B = 0.734$) and the standardized Beta (0.905), which is the strongest among all predictors. The t -value (42.410) and p -value (0.000) reinforce that motivation is a key factor in academic success. Gamified learning elements likely enhance motivation, resulting in better student performance.

The findings suggest that technological literacy has a strong positive impact on academic achievement, with an unstandardized coefficient ($B = 0.912$) and a standardized Beta (0.865). The high t -value (34.336) and p -value (0.000) confirm that students with higher technological literacy perform better academically. This indicates that familiarity with digital tools and e-learning platforms is crucial for student success in higher education.

Conclusion

The significance of intrinsic motivation and technological literacy as factors that determine student performance is brought to light by this study, which offers a significant contribution to our understanding of the ways in which gamified e-learning influences academic performance. According to the findings, gamified components have the potential to successfully stimulate intrinsic motivation, boost technology engagement, and aid academic

growth when they are well-planned and matched with learning objectives. The advent of gamified platforms, which combine the suggestions of SDT—the need for autonomy, competence, and relatedness—with the focus that TAM places on usability and perceived value, is one potential answer to the difficulties that are afflicting modern education. In order to broaden the applicability of the findings, this study also highlights the limitations of the investigation, such as the requirement for investigating other demographics and doing longitudinal research. These findings need to serve as the foundation for future research that investigates unique gamified strategies in a number of educational and cultural contexts. The findings of this study provide the foundation for the development of gamified learning environments that are not only engaging and welcoming, but also successful in catering to the requirements of a diverse spectrum of students.

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