

Research Article

The Impact of Gamified Learning on Students' Learning Engagement

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Abstract

With the rapid advancement of information technology, teaching models have undergone profound transformations. However, the issue of insufficient student engagement remains prominent in practical classroom teaching today, manifested by inadequate learning concentration, learning burnout, and diminished learning enthusiasm. As an innovative learning approach, gamified learning centers on applying elements, mechanisms, and principles of games to non-game teaching environments, aiming to stimulate learners' interest and motivation and enhance their learning initiative. To address this problem, this study adopted a mixed-methods approach combining qualitative and quantitative research, selecting two parallel classes—Class 1, Grade 8 and Class 2, Grade 7 of M Middle School—as research objects. Among them, Class 1 served as the experimental class adopting the gamified teaching model, while Class 2 was the control class using the traditional teaching model. Data analysis tools were employed to conduct pre-tests and post-tests on both classes, analyzing the impact of gamified learning on learners' engagement from three dimensions: cognitive engagement, behavioral engagement, and emotional engagement. The results indicated that gamified learning can promote students' cognitive engagement, strengthen their behavioral performance in the learning process, and foster their positive emotions toward learning. This study not only provides practical references for future educational and teaching research but also offers theoretical support for the reform direction of teaching methods.

Keywords

Gamified Learning, Learning Engagement, Behavioral Engagement, Emotional Engagement, Cognitive Engagement

1. Introduction

The alongside the rapid development of new digital technologies, represented by generative artificial intelligence and natural language processing, profound impacts have been brought to various sectors of society, including significant transformations in the field of education. Traditional educational models struggle to adapt to the learning habits and cognitive characteristics of the generation of digital natives. "China's Education Modernization 2035" explicitly proposes "to accelerate educational reform in the information age,

utilizing modern technology to promote the reform of educational models as a core independent task" [1]. Against this backdrop, the focus of education is shifting from "knowledge transmission" to "capacity building." In this process of transformation, gamified learning has emerged as a promising pedagogical approach, capable of integrating core elements of student learning motivation into the instructional design process, leveraging the underlying drivers of games as external motivation, which in turn transforms into students'

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intrinsic learning interest, immersing them in a sense of accomplishment [2]. However, in current educational practice, insufficient student learning engagement remains a core problem demanding urgent solution: at the behavioral level, low classroom participation and phenomena like "present but not engaged" are common; at the emotional level, students often lack learning interest and develop feelings of difficulty aversion and burnout; at the cognitive level, traditional classrooms often lead to rote memorization, neglecting individual student differences [3]. Therefore, how to effectively enhance students' learning engagement is a central issue requiring resolution in current educational reform and practice.

Based on the above, this study is conducted around the following research questions:

Q1: Can gamified learning effectively enhance students' learning engagement?

Q2: What specific impacts does gamified learning have on the three dimensions of behavioral, emotional, and cognitive engagement respectively?

2. Literature Review

2.1. Gamified Learning

Gamified learning refers to a pedagogical approach that reasonably integrates game experience design and incentive mechanisms into the educational process to enhance learners' participation, motivation, and cognitive outcomes [4]. Current research on gamified learning domestically and internationally shows different emphases: international research started earlier and has a relatively mature research system, primarily divided into theoretical and practical aspects. Theoretically, Lee et al. defined the content of gamified learning and systematically analyzed the design and implementation strategies for the gamified learning activities [5]. Practically, most education scholars focus on digital game-based learning and empirical research on game elements. Domestic research on gamified learning, although starting later, features rich research themes, currently focused on theoretical exploration and strategic research. In terms of theoretical exploration, Professor Zhu Zhiting believed that the essence of "edutainment" lies in the natural transformation of life experiences into learning purposes [6]. In strategic research, reviewing relevant literature reveals that gamified teaching leverages its unique advantages in optimizing teaching models and enhancing teaching effectiveness. Furthermore, guided by the current background of educational informatization and relevant national policy documents, some regions and schools have launched scaled explorations of gamified teaching practices.

2.2. Learning Engagement

Learning engagement measures the degree of energy and attention an individual invests in the learning process [7] and

is an important indicator for assessing educational quality and student development. Reviewing relevant domestic and international literature reveals that research on the dimensions of learning engagement generally falls between 2 and 4. The dimensional analysis of learning engagement in this study primarily references the research of Chinese scholar Kong Qiping, who posits that learning engagement is a combination of behavioral, emotional, and cognitive engagement, with relative independence among the three [8]. Research on learning engagement is active both domestically and internationally, but with different emphases: the international research system is mature, characterized by theory-driven and refined approaches, delving deeper into the psychological mechanisms underlying learning engagement, such as the protective role of positive psychology and growth mindset. E. J. S [9] et al. argued that student engagement should be conceptualized as an action sequence starting with triggering and ending with disengagement, studying student learning engagement from a systems theory perspective. Domestic research, although starting later, possesses a strong problem-oriented and practice-oriented value: domestic scholars have introduced Western theories while making localized adjustments, paying close attention to specific applications within the context of the new curriculum reform, and exploring enhancement strategies in specific environments. Regarding research foci, Wan Kun [10] et al. collected over 1000 samples of data on learning engagement, using visual analysis to understand the international progress and frontier trends in learning engagement in the field of education holistically. Concerning applied research and practical significance of learning engagement, Zeng Benyou [11] et al. pointed out that in the context of AI-empowered education, both the methods of knowledge acquisition and the organization of teaching forms have undergone tremendous changes. They analyzed the teaching presence in synchronous interactive delivery classrooms and explored its impact on student learning engagement. Additionally, Wei Yitong [12] et al., starting from the current situation of insufficient student classroom participation, designed a synchronous classroom teaching space model integrating physical, virtual, and social interaction spaces to explore its impact on enhancing learner engagement.

3. Research Design and Methodology

3.1. Research Design

This study primarily adopts a mixed-methods approach combining quantitative and qualitative research, aiming to investigate students' learning engagement multi-dimensionally across cognitive, behavioral, and emotional aspects. Firstly, the survey questionnaire used in this study is based on the internationally Utrecht Work Engagement Scale for Students (UWES-S) [13], employing a Likert 5-point scale to measure students. The participating students are concen-

trated in the 14-15 age range, possessing certain cognitive and expressive abilities, enabling them to understand and effectively respond to the UWES-S content, which is suitable for measuring learning engagement in this age group, ensuring the feasibility of the survey and data credibility. After reliability and validity tests, the Cronbach's Alpha coefficient for the questionnaire in this study is 0.932, and the KMO value is 0.806, indicating good reliability and validity of the questionnaire. Secondly, during the teaching process, the teacher objectively records students' overt behaviors in real-time using a classroom observation record form. Finally, after quantitatively analyzing the collected data, semi-structured interviews are conducted with the teacher and some learners research questions to gain deeper insights into students' genuine perceptions through in-depth interviews.

3.2. Quantitative Research Design

3.2.1. Research Subjects

The research subjects are all students from Class 1, Grade 8 of M Middle School. The class has 40 students, with a gender ratio close to 1:1, and ages concentrated between 14 and 15. Students in this age stage can think about problems using their own logic and possess a relatively high curiosity. Based on these cognitive characteristics, this study implements a gamified learning model in the mathematics teaching of this class, aiming to explore its impact on learner engagement by integrating gamified elements.

3.2.2. Research Procedure

The teaching experiment in this study lasts for 6 weeks, covering the content of Chapter 18 "Parallelograms" in the second-year junior high school mathematics curriculum. To evaluate the effectiveness of gamified learning on student learning engagement, a pre-test is administered to the students in the experimental class before the experiment begins, and relevant data is collected. The teaching tasks throughout the experimental period are conducted by one teacher with years of teaching experience to ensure consistency in the implementation process and control for potential influences from teacher variables. After completing the teaching tasks, a post-test is administered to the experimental class students. By comparing and analyzing the pre-test and post-test data, the impact effect of the teaching model on learning engagement is quantified.

3.3. Qualitative Research Design

3.3.1. Interview Protocol Design

This study uses semi-structured interviews to obtain qualitative research data. Its main advantages are that it ensures consistency in the interview structure around the research questions while allowing flexible follow-up questions based on the interviewees' specific responses, enabling the excava-

tion of deeper personal experiences and feelings. This ensures all interviews revolve around the core theme, possessing both preset structure and flexibility, and helps reveal those deep personal experiences during the gamified learning process that are difficult to capture through quantitative data. This study develops the interview outline framework around students' performance during the pre-class, in-class, and post-class stages of the gamified learning process, as well as their experiential feelings throughout the process.

3.3.2. Interviewees

This study employs purposive sampling to select samples that can provide the most information for the research questions, ensuring sufficient and diverse information. At the student level, based on preliminary quantitative data and teacher recommendations, students with high, medium, and low levels of engagement are selected from the experimental class implementing gamified learning for interviews. At the teacher level, the instructor responsible for the teaching tasks is interviewed to ensure richness and multi-dimensional perspectives in the interview data. Furthermore, all interview data in this study are anonymized to protect the personal privacy of the interviewees.

3.4. Data Analysis Methods

This study primarily employs a mixed-methods approach combining quantitative and qualitative research. For the quantitative aspect, SPSS software is used to process the collected experimental data: Paired-sample T-tests are used to analyze the questionnaire data from the class, testing the impact of gamified learning on students' cognitive engagement; by statistically analyzing data from the classroom observation records, changes in the overt classroom behaviors of students in the same class after implementing gamified learning are examined to assess the impact on student behavioral engagement. For the qualitative aspect, semi-structured interviews with the teacher and some students are conducted to examine the impact of gamified learning on students' emotional engagement.

4. Research Results and Analysis

4.1. Analysis of Cognitive Engagement

To verify the intervention effect of gamified learning on students' cognitive engagement, in this study, the author conducted statistical quantitative analysis on the scale scores of the experimental class, which comprised 40 students. The specific steps are as follows: After implementing the gamified learning teaching model intervention for the experimental class students, a paired-sample T-test was used to compare the changes in motivation scores before and after the intervention. The results are shown in Table 1. The test results show that the post-intervention scores ($M = 70.875$,

SD = 9.266) were significantly higher than the pre-intervention scores ($M = 55.125$, $SD = 9.819$), and a statistically significant difference existed. This indicates that

the implementation of the gamified learning teaching model had a positive effect on enhancing students' cognitive engagement.

Table 1. T-test results for paired samples of learning motivation in experimental classes.

Variable	Pre-test		Post-test		t	df	p
Cognitive engagement	M	SD	M	SD	-8.488	39	0
	55.125	9.819	70.875	9.266			

4.2. Analysis of Behavioral Engagement

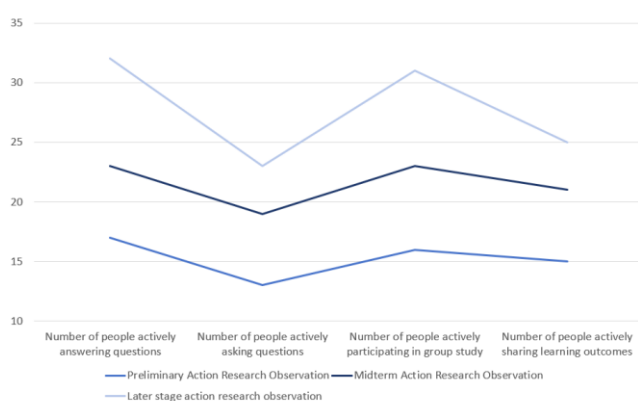


Figure 1. Student behavior input observation form.

To objectively and directly judge students' overt behaviors during the gamified learning process, the instructor in this study recorded a classroom observation form in a natural setting, using a combination of time sampling and event sampling methods for systematic recording to ensure data comparability. Statistical quantification and longitudinal analysis of the classroom observation data from the three stages before, during, and after the gamified learning intervention revealed that with the implementation of gamified learning, the number of students exhibiting behaviors across various dimensions increased, and students' behavioral engagement showed an overall upward trend throughout the research period, as shown in Figure 1. This quantitative result fully demonstrates that gamified learning effectively improved students' learning behavioral engagement and showed a continuous strengthening trend during the gamified learning process.

4.3. Analysis of Emotional Engagement

Through semi-structured interviews with the instructor and

some students – focusing on students' experiences and internal feelings during the gamified learning process, and aiming to capture changes in students' learning attitudes from the teacher's perspective – this study followed the principle of purposive sampling. Based on quantitative pre-test data and classroom observation records, 6 students were selected from the experimental class through stratified sampling, covering high, medium, and low levels of learning engagement, including 3 boys and 3 girls, all with different learning performance characteristics. This sample could relatively comprehensively reflect the emotional experience differences among students in the class, enhancing the representativeness and explanatory power of the interview results. The instructor was also invited as an interviewee to analyze students' emotional engagement from multiple perspectives. Analysis based on the interview results from both teachers and students indicated that gamified learning had a positive impact on students' emotional engagement, mainly manifested in the following aspects: First, gamified learning provided students with positive emotional experiences, and the progressively designed gamified teaching process offered a strong sense of immersion. Second, the game feedback mechanisms, such as points or badges, provided students with a strong sense of achievement and self-efficacy. Third, gamified design must also respect individual student differences; a small number of students reported feeling anxious about competitive elements, thus instructors should also focus on personalized student development during the teaching process.

5. Discussion

Therefore, future education should introduce more emerging technologies. Similarly, in the teaching process, teachers should transform their teaching models, improve teaching methods, pay attention to students' learning experiences, and emphasize the guiding role of gamified learning in teaching. However, they must also control the pace of gamified learning, be mindful of individual student differences, avoid excessive anxiety caused by competitive mechanisms resulting from "over-gamification," and ensure that gamified learning promotes the development of all students. Furthermore, besides

focusing on student performance during the teaching process, teachers should also pay attention to integrate gamified learning with educational objectives during the instructional design process, ensuring that this learning model serves the achievement of the ultimate teaching goals. Admittedly, this study has certain limitations. On the one hand, the sample scope of the study is limited, and its generalizability also need further verification. On the other hand, the selected subject range is limited, reducing persuasiveness. Future research could expand to different subjects and stages, increase the scope and number of research samples, extend the research period, and examine the sustained effects and potential changes of gamified learning in the long-term educational process, thereby enhancing the persuasiveness of this study's findings. In conclusion, this study has confirmed the positive impact of gamified learning on learner engagement. Future research should pay more attention to how to utilize gamified learning to improve student learning outcomes, as well as how to deepen the mechanisms of gamified learning and how to establish an integrated platform for research, teaching, and learning, which remain important topics for future research.

6. Conclusions

Experimental research found that gamified learning has a significant effect on enhancing learner engagement. At the cognitive level, the reward mechanisms and immediate feedback in gamified learning can mobilize students' intrinsic learning motivation, prompting them to understand and process knowledge deeply and construct their own knowledge systems. At the behavioral level, the use of gamified elements can increase students' behavioral performance in the classroom. Regarding emotional engagement, analysis of interviews with teachers and students revealed that gamified learning made the classroom atmosphere more relaxed and interesting, reducing students' resistance to learning. Certainly, a few students felt that the competitive mechanism of this learning model caused them pressure, but overall, gamified learning had a positive impact on students' emotional aspect. In summary, gamified learning not only improved student engagement across the three aspects of cognition, behavior, and emotion but, more importantly, it catalyzed a crucial shift in the teaching model – from the past where students "passively received knowledge" to now "actively participating in learning."

Author Contributions

Siqi Zhang: Conceptualization, Data curation, Writing – original draft

Lingxing Ma: Data curation, Writing – original draft

Bo Liu: Supervision, Funding acquisition, Writing – review & editing

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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