Implementing gamification in the primary school basketball curriculum for fourth-grade students at Baoshan Experimental School of East China Normal University

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Abstract

Background and Aims: This study aimed to investigate the effectiveness of a gamified teaching model in primary school basketball courses. The study had two primary objectives: (1) to evaluate improvements in students' fundamental basketball skills, specifically half-court dribbling and stationary shooting, and (2) to examine the effects of the gamified teaching model on students' interest in learning basketball.

Methodology: The study employed simple random sampling to select participants from the target population. Three types of research instruments were utilized:

1) Contextualized basketball curriculum design: Integrated fundamental skills such as dribbling, passing, and shooting into structured, simulated game-based activities to promote active engagement and skill acquisition, 2) Basketball skill test: A 10-point scale assessment measuring students' proficiency in dribbling and shooting, including specialized items targeting both accuracy and efficiency, 3) Interest questionnaire: A 15-item, five-point Likert scale survey (Cronbach's α = 0.82) to assess students' engagement

and attitudes toward learning, supplemented with open-ended questions to collect qualitative data regarding their experiences.

Results: Statistical analyses were conducted using SPSS version 26.0, focusing on descriptive statistics (means and standard deviations) and inferential statistics using paired-sample t-tests at a significance level of $p < 0.05$. The results indicated that the average time for the half-turn dribble decreased significantly from 25.82 seconds to 23.65 seconds ($t(29) = -2.089$, $p = 0.046$). In addition, the number of successful stationary shots increased from 3.87 to 5.10 ($t(29) = 2.434$, $p = 0.021$). Students' overall interest in learning basketball also improved significantly, with the total interest score rising from 83.07 to 101.67 ($p < 0.001$). Specifically, there were notable improvements in self-directed learning, classroom participation, and positive learning emotions, while negative emotions decreased significantly. These findings suggest that the gamified teaching model effectively enhanced both basketball skill performance and students' engagement in learning.In summary, the results showed significant improvements in both skills and interest. Students' interest in learning basketball increased significantly, and technical assessments showed significant improvements in dribbling speed and control, as well as shooting accuracy and form.

Conclusion: In conclusion, the implementation of gamified teaching significantly enhanced students' basketball skills and effectively increased their interest in learning, engagement, and positive emotional experiences while reducing negative emotions. Compared to traditional teaching methods, this approach offers comprehensive pedagogical advantages. The findings of this study provide a practical and empirically supported teaching model that can inform the reform and advancement of primary school basketball curricula. Furthermore, the study has important implications for promoting teacher innovation in the classroom, fostering students' interest in physical education, and improving the overall quality of school-based physical education programs.

Keyword: Game teaching; Basketball curriculum; Primary education; Learning interest; Skill development

Introduction

School physical education in China plays a crucial role in enhancing students' physical fitness through physical exercise during their growth and development. It collaborates with other educational domains to foster students' all-round development in morality, intelligence, physical fitness, aesthetics, and labor skills, while cultivating sound moral character from the primary school stage.

For a long time, traditional physical education in China has focused on the transmission of knowledge and skills, resulting in a classroom teaching format where teachers lecture and students imitate. This has led to low student motivation and poor learning outcomes, leaving physical education classes with a long-standing reputation among students as dull and uninteresting, making it difficult to spark their interest. How to conduct physical education classes to improve teaching effectiveness, inspire students to want to engage in physical activity, and encourage them to actively participate in physical education learning and exercise, thereby enhancing their physical health, has become an important area of academic research. The National Medium- and Long-Term Education Reform and Development Plan Outline (2010-2020) (hereinafter referred to as the 'Outline') explicitly requires 'deepening reforms in curriculum and teaching methods,' aiming to alter the current situation where traditional curriculum implementation overly emphasises students' passive learning, rote memorisation, and mechanical training. It advocates that teachers should focus on students' learning interests in teaching, enabling students to actively participate in the classroom. Physical education gamification can enhance the fun and vitality of the classroom, making teaching no longer boring, aligning with the educational philosophy of the new curriculum reform, and meeting the current requirements for primary school physical education.

Since the 20th century, scholars around the world have been considering how to enable students to learn happily, thereby promoting their physical and mental health and growth. In the United States, primary education incorporates a significant amount of game-based elements into teaching methods after students enter elementary school. As emphasised by John Dewey, the American pragmatist philosopher and educator in the early 20th century, students should strive to 'learn by doing' and 'learn from

experience,' meaning they should experience the joy of learning through games and ultimately gain knowledge. Current research underscores the pedagogical potential of these approaches. Bunker and Thorpe's (1982) Teaching Games for Understanding (TGfU) model marked a pivotal shift from teacher-centered to learner-centered PE, and its principles have been updated in recent years to integrate digital and narrative elements (Harvey & Pill, 2020). Domestically, Li Jilin's situational teaching framework has been revitalized through technology-enhanced storytelling in PE contexts (Chen & Liu, 2021). Recent studies indicate that gamification can significantly increase students' enjoyment, persistence, and teamwork while reducing performance anxiety (Zhao, 2022; Hanus & Fox, 2015; Zainuddin et al., 2020). Additionally, interest and emotion remain key predictors of learning success: Pekrun et al. (2017) linked positive emotions to higher achievement, while Renninger and Hidi (2019) reinforced the role of situational interest in sustaining engagement.

 There is no doubt that these studies on gamified teaching and the application of game-based learning in education generally recognise the educational and instructional value of games, and agree that teaching activities should be conducted in a joyful manner. However, it is important to note that these studies have primarily focused on secondary school students in Western regions, neglecting surveys and research on Chinese primary school students. Furthermore, they have not incorporated both Chinese primary school students and basketball into the scope of gamified curriculum research, making it impossible to determine whether this theory is applicable to promoting the development of Chinese primary school students. Therefore,, considering the widespread popularity of basketball in China, integrating basketball with game-based physical education instruction is a feasible approach. Furthermore, since fourth-grade students are at a critical stage of physical and mental development and do not face significant academic pressure, this group is the most suitable target for the experiment.

In summary,The study addressed the challenge of low student engagement in traditional physical education by introducing gamification into the basketball curriculum. This teaching model incorporates storytelling, cooperative scenarios, and competitive games to promote interest and active learning.

Research Objectives

This study compares conventional teaching methods with scenario-based, gamified teaching methods, employing different approaches and tools. The effectiveness of these methods in elementary school basketball classrooms is evaluated by examining changes in students' interest in learning, their proficiency levels in basketball skills, and their physical fitness test results. Conducting empirical research on scenario-based teaching methods in primary school basketball education also involves incorporating new teaching concepts and methods into basketball instruction.

Research Hypothesis

1. After learning through gamification, students' basketball skills will be higher than that before learning with statistically significant

2. After gamification teaching, students' interest in learning basketball will be at least good level

Conceptual Framework

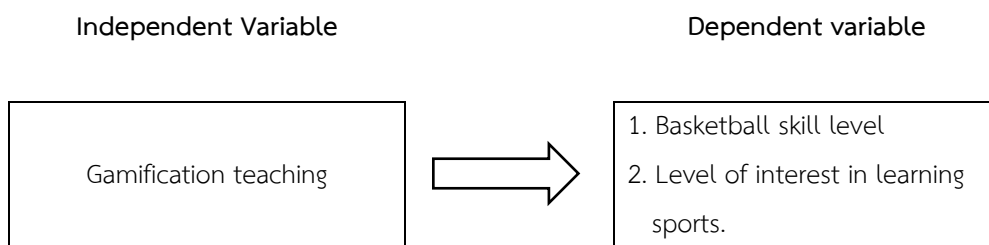The framework connects Gamification with Basketball Skill Development and Learning Interest.

Independent Variable		Dependent variable
Gamification teaching	$\longrightarrow$	1. Basketball skill level 2. Level of interest in learning sports.

Figure 1 Research Conceptual Framework

Research Methodology

1. Research Design

This study employs a One-Group Pretest-Posttest Design to evaluate the effectiveness of game-based teaching. The design follows the sequence: O_1 (pretest) $\longrightarrow$

X (intervention: game-based teaching) $\rightarrow$ O_2 (posttest). The pretest (O_1) establishes a baseline measurement of participants' knowledge or skills prior to the intervention. After implementing the game-based teaching strategy (X), a posttest (O_2) is administered. By comparing changes between the pretest (O_1) and posttest (O_2) results, this design allows for the assessment of the intervention's impact on the targeted learning outcomes.

2. Population and Sample

The study was conducted at Baoshan Experimental School affiliated with East China Normal University in East China. This experiment took place over a period of 6 weeks, from September to October 2024. Students participated in two 35-minute physical education classes per week.

The target population comprised 270 fourth-grade students distributed across six classes. From this population, a sample of 30 participants (15 males and 15 females) was randomly selected. To minimize confounding variables, student-athletes and individuals with chronic diseases were excluded. A Single-Blind Design was implemented throughout the experiment, with all instructional sessions delivered by the same instructor. Key variables were rigorously controlled to ensure experimental fairness and validity of the intervention outcomes.

3. Research Instrumentation

The study employed three key instruments to implement and evaluate the intervention. Lesson plans were developed to integrate core basketball skills—dribbling, passing, and shooting—into structured game-like activities. A standardized Basketball Skills Test (10-point scale) was administered as both pretest (O_1) and posttest (O_2), comprising a 5-point dribbling assessment and 5-point shooting accuracy evaluation. Additionally, a 15-item Interest Questionnaire utilized a five-point Likert scale (Cronbach's α = 0.82) to measure three dimensions: cognitive engagement, emotional response, and behavioral participation. Questionnaire results were categorized into four performance tiers: Excellent (≥45 points), Good (36–44), Fair (27–35), and Poor (≤26).

4. Development and Creation of Research Tool

The study involved a systematic development process for all research instruments. The teaching plan was carefully designed, incorporating clear instructional objectives, situational scenarios, game-based elements, and structured lesson

arrangements, followed by iterative revisions based on trial teaching sessions. For the basketball skills test, specific content (dribbling and shooting drills) and scoring criteria (10-point scale) were established, with reliability and validity verified through pilot testing. The interest questionnaire was developed using a combination of closed-ended (5-point Likert scale) and open-ended questions, organized across key dimensions (cognition, emotion, behavior). Preliminary testing ensured question clarity and appropriate adjustments before final implementation.

5. Data Collection Methods

This study employed multiple approaches to collect and analyze data. First, a basketball skills test was conducted to assess students' proficiency in dribbling, shooting, and passing. Second, an interest questionnaire was administered twice—before and after the intervention—to evaluate changes in students' engagement with basketball. To statistically compare pre- and post-test results, a paired t-test was used, determining whether the game-based teaching intervention had a significant impact. Additionally, the reliability of the questionnaire was verified using Cronbach's alpha (α), while its validity was confirmed through the Index of Consistency (IOC), ensuring the measurement tools were both consistent and accurate.

6. Data Analysis and Statistical Methods

The study employed rigorous statistical analyses to evaluate intervention outcomes. For basketball skill development, a paired samples t-test was conducted to compare pre- and post-test performance scores. Questionnaire data were analyzed through two approaches: (1) Likert-scale responses were aggregated into total scores and categorized into performance grades (Excellent, Good, Fair, Poor), with t-tests applied to determine significant differences; and (2) open-ended responses underwent thematic content analysis to identify emerging patterns. All quantitative analyses were performed using SPSS (Version 26.0), with statistical significance determined at $p < 0.05$. This dual analytical approach ensured both measurable outcomes and qualitative insights were captured.

Research results

1 . Experts evaluated the effectiveness of a gamified basketball instructional module for fourth-grade students at Baoshan Experimental School.

Table 1 Effectiveness of basketball skill learning

Skill Component	Pretest Mean	Posttest Mean
Halfcourt Dribbling (sec)	25.82	23.65
Fixed point Shooting (score out of 5)	3.87	5.10

As shown in Table 1: Skill Performance Improvement: As shown in the table, participants demonstrated significant improvement in both basketball skill tests. In the Halfcourt Dribbling test, the average time decreased from 25.82 seconds to 23.65 seconds, indicating improved dribbling speed and ball-handling efficiency. In the Fixed Point Shooting test, the average score increased from 3.87 (out of 5) to 5.10, indicating a significant improvement in shooting accuracy and consistency.

2. Experts assessed the impact of gamification on student interest and engagement in the basketball instructional module for fourth-grade students at Baoshan Experimental School.

Table 2 Comparison of Interest Dimensions Before and After Gamification

Interest Dimension	Pretest Score	Posttest Score	Improvement
Overall Interest	83.07	101.67	+18.60
Self directed Learning	Moderate	High	↑(Improvement)
Positive Learning Emotion	Moderate	High	↑(Improvement)
Negative Learning Emotion	High	Low	↓(Reduction)
Classroom Participation	Moderate	High	↑(Improvement)
Interest Dimension	Pretest Score	Posttest Score	Improvement

As shown in Table 2: Interest and Engagement Improvement: As shown in the table, students exhibited notable progress across all interest dimensions. The overall interest score increased by 18.60 points, reflecting heightened engagement. Self-directed learning, positive emotions, and classroom participation all improved from moderate to high levels, indicating that gamification fostered greater autonomy and active involvement. Additionally, negative emotions such as anxiety and boredom decreased significantly (from high to low), highlighting the method's effectiveness in creating a more supportive and motivating learning environment.

Summary: The gamified approach not only enhanced skill acquisition (as shown in Table 1) but also positively influenced students' attitudes toward learning. The reduction in negative emotions and the rise in self-directed participation suggest that gamification promotes both psychological safety and intrinsic motivation, making it a valuable strategy for modern physical education.

(Note: If statistical significance data is available, it can be included to further strengthen the conclusions.)

This study conducted a six-week gamified teaching experiment in the fourth-grade basketball course at Baoshan Experimental School of East China Normal University, using a single-group pre- and post-test design with 30 students participating. The experiment was conducted three times a week, integrating core basketball skills such as half-court dribbling and stationary shooting into interactive games. Skill test results showed that the average time taken for half-turn dribbling decreased from 25.82 seconds to 23.65 seconds ($t(29) = -2.089$, $p = 0.046$), and the number of successful stationary shots increased from 3.87 to 5.10 ($t(29) = 2.434$, $p = 0.021$), both of which showed significant differences. Interest survey results showed that students' total interest scores significantly increased from 83.07 points to 101.67 points ($p < 0.001$), with significant increases in self-directed learning levels, classroom participation, and positive learning emotions, and a significant decrease in negative learning emotions. Qualitative analysis results indicated that students generally perceived the gamified teaching process as highly engaging and enjoyable, and that it helped enhance team collaboration and learning motivation.

Discussion of results

The research results confirm that gamified and contextualized teaching models can effectively enhance primary school students' basketball skill levels and learning interest. In terms of skills, contextualized games provide opportunities for repeated practice and immediate feedback, enabling students to consolidate movement techniques and reduce completion times in a low-pressure, high-interest environment. In terms of interest and emotions, the gamified structure stimulates students' sense of achievement and belonging through storylines, competitive elements, and cooperative tasks, while reducing frustration caused by technical difficulties.

Additionally, this study found a positive correlation between improved positive emotions and skill progression, indicating that emotional experiences are not merely ancillary effects of learning outcomes but also important drivers of motor skill acquisition. This finding aligns with recent educational psychology research, which suggests that positive emotions enhance learning engagement and self-efficacy, thereby fostering a virtuous cycle of skill development and interest.

Recommendation

1. Optimizing teaching strategies: In primary school basketball courses, contextual and gamified elements can be introduced systematically, combining skill training with narrative tasks to ensure that the classroom remains challenging and fun.

2. Multi-dimensional evaluation: In addition to skill-based assessments, teachers should use interest questionnaires and emotional observations to conduct a comprehensive evaluation of students' cognitive, emotional and social development.

3. Strengthening teamwork: Team-based competitions and collaborative tasks can enhance students' cooperation and communication, thereby improving classroom engagement and fostering a sense of collective belonging.

4. Promotion and adaptation: This model can be extended to other grade levels or sports disciplines. Content and difficulty should be adjusted according to age characteristics and sport-specific features to achieve broader application value.

5. Continuous feedback mechanism: It is recommended that an immediate feedback and stage summary mechanism is established in teaching, to enable students to promptly understand their progress and maintain their learning motivation.

References

Bunker, D., & Thorpe, R. (1982). A model for the teaching of games in secondary schools. Bulletin of Physical Education, 18(1), 5–8.

Cao, Q. (2014). Research on the situational teaching method in physical education [Master's thesis, Nanchang University]. Nanchang University. [in Chinese]

Chen, C. (2004). The application of situational education in physical education. Journal of the College of Physical Education of Shanxi Normal University, 2(1), 45–48. [in Chinese]

Deng, X., & Tan, H. (2008). New theory of physical education. East China Normal University Press. [in Chinese]

Dewey, J. (1938). Experience and education. Kappa Delta Pi.

Feng, Y. (2018). Practice and reflection on situational teaching in senior high school physical education. Exam Weekly, 16(3), 45–47. [in Chinese]

Fu, J. (2006). General psychology (2nd ed.). Tsinghua University Press. [in Chinese]

Gu, S. (2015). Analysis on applying situational teaching in physical education. Times Education, 10(4), 50–51. [in Chinese]

Gu, Y., & Tan, X. (2007). Application of situational teaching in junior high school physical education. Physical Education, 1(2), 34–37. [in Chinese]

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. Computers & Education, 80, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019

Harvey, S., Pill, S., & Almond, L. (2018). Old wine in new bottles: A response to claims that teaching games for understanding was not developed as a theoretically based pedagogical framework. Physical Education and Sport Pedagogy, 23(2), 166–180. https://doi.org/10.1080/17408989.2017.1359526

Herbart, J. F. (1990). Outlines of pedagogical instruction (L. Qilong, Trans.). Jiangsu Education Publishing House. [in Chinese; original work in German]

Hidi, S. (2006). Interest: A unique motivational variable. Educational Research Review, 1(2), 69–82. https://doi.org/10.1016/j.edurev.2006.09.001

Hua, C. (2012). Strategies for creating effective teaching situations. Video Education in Primary and Secondary Schools, 1(5), 61–63. [in Chinese]

Li, T. (2019). Studies on the application and effective strategies of gym class [Unpublished manuscript]. [in Chinese]

Nunnally, J. C. (1978). Psychometric theory (2nd ed.). McGraw–Hill.

Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. Educational Psychologist, 37(2), 91–105. https://doi.org/10.1207/S15326985EP3702_4

Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: Longitudinal models of reciprocal effects. Child Development, 88(5), 1653–1670. https://doi.org/10.1111/cdev.12704

Renninger, K. A., & Hidi, S. E. (2019). Interest development and its relation to curiosity: Needed neuroscientific research. Educational Psychology Review, 31, 833–852. https://doi.org/10.1007/s10648-019-09491-3

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. Educational Research Review, 30, 100326. https://doi.org/10.1016/j.edurev.2020.100326

Zhang, Z. (2020). Run away, equip with 21st-century skills! [Unpublished manuscript]. [in Chinese]

Zhao, K. (2022). The student buy-in: The effects of digital story-driven teaching on student motivation and classroom engagement [Unpublished manuscript]. [in Chinese]