



Innovative teaching methods to foster creative thinking among physical education students at Hanoi Metropolitan University

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Abstract

Problem Statement: Physical education training increasingly requires students to move beyond the reproduction of technical movements and develop the capacity to generate flexible, original, and context-sensitive solutions. Conventional teacher-centered instruction, however, may provide limited opportunities for active participation, experimentation, and creative problem solving.

Approach: The study used a controlled pre-test-post-test design with 60 Physical Education students. The experimental group ($n = 30$) received instruction integrating problem-based learning, gamification, and video analysis, whereas the control group ($n = 30$) followed conventional teaching methods. Data were collected through pedagogical observation, interviews with students and lecturers, and pre-test-post-test assessment. Mean comparisons, t-tests, correlation analysis, and qualitative analysis were used.

Purpose: The study examined the effect of innovative teaching methods on students' creative thinking and explored the relationships of learning motivation, student engagement, and the learning environment with that outcome.

Results: The two groups had comparable baseline means (5.21 and 5.18). After the intervention, the experimental group increased to 8.03 (change = 2.82; $t = 12.45$; $p < .001$), while the control group increased to 6.02 (change = 0.84; $t = 4.12$; $p < .05$). Post-test scores favored the experimental group for flexibility (8.12 vs. 6.21; $t = 6.35$; $p < .001$), originality (7.95 vs. 6.05; $t = 5.98$; $p < .001$), and fluency (8.34 vs. 6.42; $t = 6.72$; $p < .001$). Student engagement ($r = .68$) and learning motivation ($r = .72$) were positively associated with creative thinking (both $p < .001$).

Conclusions: Integrating problem-based learning, gamification, and video analysis was associated with greater improvement in creative thinking than conventional instruction. The findings support constructivist and active-learning approaches in Physical Education and suggest that motivation, engagement, and the learning environment should be considered when designing creative learning experiences.

Keywords: Innovative teaching methods, creative thinking, physical education, problem-based learning, gamification, video analysis

Introduction

Digital transformation and competency-based education are reshaping higher education, including Physical Education (PE). Contemporary PE students are expected not only to perform technical movements correctly but also to manage movement-related information, use digital tools, and make tactical decisions in changing situations. National competency-oriented reforms have similarly emphasized the development of active learners who can apply knowledge in practice (Ministry of Education and Training, 2018; Nguyễn, 2020)^[6, 7].

Creative thinking refers to the capacity to generate ideas that are new, original, and useful. In PE, this capacity is expressed when students design exercises, respond to movement situations, adapt tactical solutions, and develop new teaching approaches. Creative thinking is therefore not detached from bodily action; it is embedded in context, movement, and real-time decision making.

Constructivist theory views learners as active participants who build knowledge through interaction and experience (Vygotsky, 1978)^[9]. Problem-based learning (PBL) provides opportunities to investigate authentic problems and construct solutions (Hmelo-Silver, 2004; Truong, 2019)^[4, 8], while experiential learning emphasizes cycles of concrete experience, reflection, conceptualization, and application (Kolb, 1984)^[5]. Gamification uses game-design elements in

non-game contexts (Deterding *et al.*, 2011)^[2] and may strengthen participation and motivation (Hamari *et al.*, 2014)^[3]. Video analysis can additionally support reflection and self-correction during movement learning.

Against this theoretical background, the study examined whether an instructional intervention combining PBL, gamification, and video analysis could foster creative thinking among PE students at Hanoi Metropolitan University. It also explored how learning motivation, student engagement, and the learning environment were related to creative thinking. The study was guided by the expectation that innovative, active-learning methods would produce greater pre-test-post-test improvement than conventional instruction.

Materials and Methods

1. Research Design and Participants

A controlled experimental design with pre-test and post-test measurements was used. The study involved 60 PE students: 30 in the experimental group and 30 in the control group. The two groups were evaluated before and after the instructional intervention.

2. Instructional Intervention

The experimental group studied through an integrated set of innovative teaching methods comprising PBL, gamification,

and video analysis. The control group received conventional instruction. The intervention was intended to increase opportunities for problem solving, active participation, reflection, and the development of original movement and teaching solutions.

3. Data Collection

Data were collected using pedagogical observation, interviews with students and lecturers, and pre-test-post-test assessment. Creative thinking was examined both as an overall outcome and through three components: flexibility, originality, and fluency. Learning motivation, student engagement, and the learning environment were considered in the proposed explanatory framework.

4. Data Analysis

The analysis included comparisons of mean scores, t-tests for pre-test-post-test change and between-group post-test differences, correlation coefficients for the relationships of motivation and engagement with creative thinking, and qualitative interpretation of observation and interview data. Statistical significance was reported at $p < .05$ and $p < .001$, as shown in the original dataset.

Results

1. Overall Creative-Thinking Scores

At pre-test, the experimental and control groups had similar mean creative-thinking scores (5.21 and 5.18, respectively), a difference of approximately 0.03 points. Post-test scores increased in both groups, with a larger increase in the experimental group.

Table 1: Comparison of Pre-test and Post-test Creative-Thinking Scores

Group	Pre-test, M +/- SD	Post-test, M +/- SD	t	p
Experimental	5.21 +/- 0.82	8.03 +/- 0.75	12.45	< .001
Control	5.18 +/- 0.79	6.02 +/- 0.81	4.12	< .05

The experimental group increased from 5.21 to 8.03 (change = 2.82; $t = 12.45$; $p < .001$). The control group increased from 5.18 to 6.02 (change = 0.84; $t = 4.12$; $p < .05$).

2. Components of Creative Thinking

Table 2: Post-test Comparison of Creative-Thinking Components

Component	Experimental	Control	t	p
Flexibility	8.12	6.21	6.35	< .001
Originality	7.95	6.05	5.98	< .001
Fluency	8.34	6.42	6.72	< .001

At post-test, the experimental group obtained higher scores than the control group in flexibility (8.12 vs. 6.21), originality (7.95 vs. 6.05), and fluency (8.34 vs. 6.42). All three between-group comparisons were statistically significant at $p < .001$.

3. Correlations with Creative Thinking

Table 3: Correlations of Engagement and Motivation with Creative Thinking

Relationship	r	p
Student engagement - creative thinking	.68	< .001
Learning motivation - creative thinking	.72	< .001

Student engagement was positively correlated with creative thinking ($r = .68$; $p < .001$), as was learning motivation ($r = .72$; $p < .001$).

Discussion

1. Effect of Innovative Teaching Methods

The results provide evidence that the integrated use of PBL, gamification, and video analysis was associated with greater improvement in PE students' creative thinking than conventional instruction. The statistically significant gain in the experimental group is consistent with research emphasizing active learning environments and the development of higher-order thinking (Hmelo-Silver, 2004) [4].

The improvement across flexibility, originality, and fluency suggests that creative thinking in PE is responsive to instructional design. When teaching moves from technical reproduction toward problem solving and experience-based learning, students encounter cognitive challenges that require them to generate, test, and refine alternative solutions. This interpretation is compatible with constructivist theory (Vygotsky, 1978) and experiential learning (Kolb, 1984) [5, 9].

2. Learning Motivation and Student Engagement

The positive correlations of student engagement ($r = .68$) and learning motivation ($r = .72$) with creative thinking suggest that these variables may help explain how innovative teaching supports creativity. This interpretation aligns with self-determination theory, in which intrinsic motivation is strengthened by autonomy and perceived competence and can support creative activity (Deci & Ryan, 2000) [1]. Because the reported analysis was correlational, these relationships should be interpreted as associations rather than confirmed mediation effects.

3. Role of Gamification and Video Analysis

Gamification and video analysis illustrate how technology can support rather than merely accompany pedagogical change. Gamification can increase participation by organizing goals, feedback, and challenge through game-design elements (Deterding *et al.*, 2011) [2], and previous research has documented generally positive effects on engagement (Hamari *et al.*, 2014) [3]. Video analysis can function as a metacognitive tool by enabling students to observe performance, identify alternatives, and adjust movement strategies.

4. Proposed Conceptual Framework

The proposed framework presents both direct and indirect pathways from innovative teaching methods to creative thinking. Learning motivation and student engagement are positioned as potential mediators, while the learning environment is positioned as a potential moderator. The framework expresses hypotheses suggested by the study findings; the mediation and moderation paths require direct statistical testing in future research.

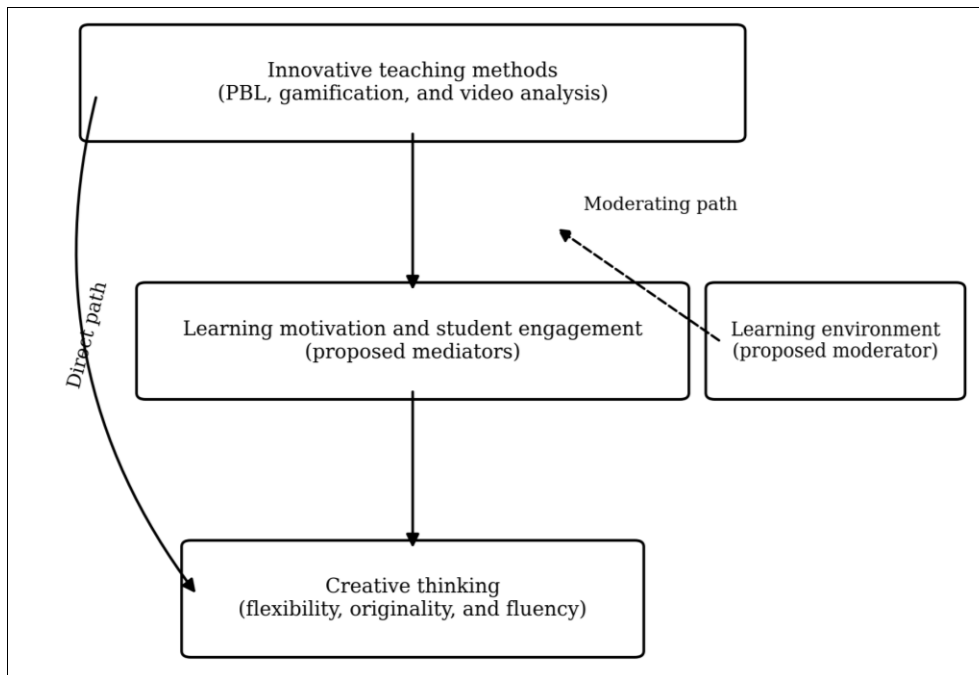


Fig 1: Proposed Conceptual Framework

Conclusions

The study indicates that active, technology-supported teaching methods can improve creative thinking among PE students. Compared with conventional instruction, the integrated use of PBL, gamification, and video analysis was associated with larger gains in overall creative thinking and higher post-test scores in flexibility, originality, and fluency. Learning motivation and student engagement were also strongly and positively associated with creative thinking. Hanoi Metropolitan University should continue strengthening facilities, digital infrastructure, and learning resources that support active teaching. Lecturers should develop both pedagogical and digital competence and shift from one-way transmission toward the organization and facilitation of creative learning activities. PE curricula should expand practice-based and experiential tasks that allow students to apply knowledge, reflect on performance, and generate alternative solutions.

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