

TECHNOLOGY FOR DEVELOPING CREATIVE THINKING OF UNIVERSITY STUDENTS IN A DIGITAL EDUCATIONAL ENVIRONMENT

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Annotation: The rapid advancement of digital technologies has settings fundamentally transformed higher education, necessitating innovative approaches to fostering creative thinking among university students. This study investigates the effectiveness of a technology-based instructional framework designed to develop creative thinking skills within digital learning environments. A quasi-experimental study was conducted involving 200 university students divided into experimental and control groups. The experimental group was exposed to a specially designed digital instructional technology incorporating collaborative platforms, project-based learning, and AI-assisted tools, while the control group followed traditional instructional methods. Results demonstrated statistically significant improvements in creative thinking indicators — including fluency, flexibility, originality, and elaboration — among students in the experimental group. The findings suggest that purposeful integration of digital tools within a structured pedagogical framework significantly enhances creative thinking development in higher education

Keywords: creative thinking, digital educational environment, university students, educational technology, higher education, instructional design

Introduction

The integration of digital technologies in higher education has created new opportunities for developing students' cognitive and creative capacities. In the context of the 21st century, creative thinking is recognized as one of the most essential competencies for professional success and lifelong learning (Runco & Jaeger, 2012). However, despite the widespread adoption of digital tools in universities, systematic approaches to leveraging these tools for the explicit development of creative thinking remain underexplored.

Digital educational environments — characterized by interactive platforms, collaborative tools, and AI-assisted systems — offer unique affordances that can scaffold and stimulate creative cognitive processes. Yet, the mere presence of technology does not automatically translate into enhanced creativity; rather, it requires deliberate pedagogical design (Henriksen et al., 2016).

This study addresses the gap by proposing and empirically testing a structured instructional technology framework aimed at developing creative thinking among university students. The research was conducted with 200 students across two groups, measuring outcomes across four dimensions of creativity: fluency, flexibility, originality, and elaboration.

Literature Review

Creative thinking has been extensively studied within educational psychology, most notably through Guilford's (1967) model of divergent thinking, which identifies fluency, flexibility, originality, and elaboration as core components. Torrance (1974) further operationalized these constructs in his widely-used assessment tools.

In digital learning contexts, researchers have highlighted the potential of technology-enhanced environments to foster creativity. Mishra and Koehler (2006) introduced the

Technological Pedagogical Content Knowledge (TPACK) framework, emphasizing that effective technology integration requires alignment between technology, pedagogy, and content. More recent studies have explored the role of specific digital tools — such as collaborative mind-mapping, project-based learning platforms, and generative AI — in stimulating creative thought processes (Cropley, 2019; Kim & Jang, 2021).

Despite these advances, a coherent technology for deliberately sequencing and scaffolding creative thinking development in digital university settings remains a gap in the literature, particularly within Central Asian higher education contexts.

Methodology

A quasi-experimental pretest-posttest control group design was employed. Participants included 200 university students ($n = 100$ experimental, $n = 100$ control) enrolled in undergraduate programs. The two groups were matched on baseline creative thinking scores, age, and academic year.

The proposed framework comprises three interconnected phases applied over a 12-week semester:

Phase 1 — Divergent Exploration (Weeks 1–4): Students engaged with open-ended digital tasks using collaborative platforms (Miro, Padlet). They were encouraged to generate multiple ideas without judgment, promoting fluency and flexibility.

Phase 2 — Structured Creation (Weeks 5–8): Project-based learning tasks required students to develop original digital products (multimedia presentations, prototypes) using tools such as Canva and Adobe Express. Peer feedback was facilitated through online rubrics.

Phase 3 — Reflective Refinement (Weeks 9–12): Students iteratively improved their projects using AI-assisted feedback tools, focusing on elaboration and originality. Metacognitive reflection journals were maintained digitally. Creative thinking was assessed using an adapted version of the Torrance Tests of Creative Thinking (TTCT), supplemented by a validated digital creativity rubric. Assessments were administered pre- and post-intervention. Inter-rater reliability was established at $r = 0.89$.

Table 1 presents the mean scores and standard deviations for both groups on the four creative thinking dimensions, before and after the intervention.

Table 1. Pre- and Post-test Results of Creative Thinking Dimensions

Dimension	Control Pre	Control Post	Exp. Pre	Exp. Post	p-value
Fluency	14.2 (2.1)	15.0 (2.3)	14.1 (2.0)	19.8 (2.4)	< 0.001
Flexibility	12.8 (1.9)	13.4 (2.0)	12.9 (1.8)	18.3 (2.1)	< 0.001
Originality	11.5 (2.3)	12.1 (2.4)	11.6 (2.2)	17.9 (2.5)	< 0.001
Elaboration	13.1 (2.0)	13.8 (2.1)	13.0 (1.9)	18.6 (2.2)	< 0.001

Note: Values are mean scores (SD). Exp. = Experimental group.

The experimental group demonstrated statistically significant gains across all four dimensions following the 12-week intervention ($p < 0.001$). The most pronounced improvement was observed in fluency (+5.7 points) and elaboration (+5.6 points). In contrast, the control group showed only marginal, non-significant improvements. Independent samples t-tests confirmed significant between-group differences at posttest across all dimensions.

The results provide compelling evidence that a structured, phased instructional technology framework can significantly enhance creative thinking among university students in digital learning environments. The progressive scaffolding from divergent exploration to structured creation and reflective refinement appears to address distinct components of creativity in a complementary manner.

These findings align with prior research emphasizing the importance of deliberate pedagogical design in technology-enhanced environments (Henriksen et al., 2016; Kim & Jang, 2021). Specifically, the use of collaborative digital platforms in Phase 1 supported the social dimension of creativity, while AI-assisted feedback in Phase 3 provided personalized scaffolding that traditional classroom settings rarely afford.

The relatively stronger gains in fluency and elaboration suggest that digital tools are particularly effective at broadening idea generation and deepening idea development — two areas where traditional instruction often falls short. These insights have direct implications for curriculum design in higher education.

Conclusion

This study demonstrates that a purposefully designed digital instructional technology framework can significantly develop creative thinking among university students. The three-phase model — divergent exploration, structured creation, and reflective refinement — proved effective across all four creativity dimensions measured.

Future research should explore the long-term sustainability of these gains, examine disciplinary variations in outcomes, and investigate the role of specific digital tools in moderating creative development. Practitioners are encouraged to adopt structured, theory-grounded approaches when integrating digital technologies for creative learning objectives.

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