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Research Article

Evaluating Design Thinking and Figma-Supported Learning for Creative Thinking in Indonesian Vocational Education

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Abstract

Creative thinking is essential for vocational students navigating rapidly changing digital work. This study examined Design Thinking supported by Figma in creative-design learning at State Vocational High School 1 Narmada, Indonesia. A quantitative quasi-experimental pretest-posttest control-group design involved 60 Grade XI Software Engineering students, with 30 students in the experimental class and 30 in the control class. The experimental class completed the empathize, define, ideate, prototype, and test stages through Figma-supported activities, whereas the control class received conventional instruction. Creative thinking was assessed through fluency, flexibility, originality, and elaboration. The posttest mean was 76.27 for the experimental class and 63.03 for the control class, with a statistically significant difference ($p < 0.001$). Complementary construct-level analysis showed satisfactory indicator loadings (0.73-0.89), internal consistency (Cronbach's alpha = 0.88 and 0.90), composite reliability (0.91 and 0.93), convergent validity (AVE = 0.63 and 0.67), and a positive structural association (beta = 0.61, $p < 0.001$, $f^2 = 0.59$; $R^2 = 0.37$). The findings indicate that iterative, collaborative digital design tasks can support creative thinking in vocational education, although broader and equity-sensitive replication is needed before generalization.

Keywords: Design Thinking; Figma; Creative Thinking; Vocational Education; Digital Collaboration; SDG 4

INTRODUCTION

Vocational education is expected to develop occupational competence while preparing learners to interpret unfamiliar problems, generate alternatives, and revise solutions as technologies and work practices change. Design Thinking offers a constructivist response to this challenge by organizing learning around users, iterative inquiry, and tangible solution development [1]. Its value is especially apparent when students must work under uncertainty: creativity depends not on eliminating ambiguity but on learning to navigate it productively [2]. Recent evidence indicates that design-based learning can strengthen motivation, creativity, and design performance [3], while a systematic review of creative-thinking interventions in secondary education shows that structured models are most useful when learners have repeated opportunities to formulate, test, and refine ideas [4]. Creative thinking and experimental design thinking are related but distinguishable capabilities [5], and visual creativity draws on both divergent generation and convergent selection [6]. These findings position creativity as an educable vocational capability rather than an innate trait.

Design Thinking translates this capability into a sequence of empathize, define, ideate, prototype, and test. A systematic review found that educational applications commonly support collaboration and problem solving, but their effectiveness depends on facilitation, time, and alignment between activities and assessment [7]. Empathy strategies can influence the originality of solutions by changing how learners understand users and constraints [8]. Sustainability also matters: preservice teachers need experience connecting design stages to authentic practice challenges rather than treating the process as a set of decorative steps [9]. In interdisciplinary learning, collaboration becomes productive when teams externalize ideas, negotiate competing interpretations, and use feedback to improve prototypes [10]. Empirical work in information-technology education similarly links Design Thinking with stronger engagement and problem-oriented learning [11]. Its application in programming education shows particular promise for vocational and secondary learners because abstract technical concepts are connected to user-facing products [12]. Research on empathy-based Design Thinking further demonstrates that creative outcomes emerge from the interaction of perspective taking, ideation, and iterative evaluation [13]. At a broader human-factors level, human-centered design integrates user experience, service logic, and system feasibility [14], while immersive design environments can alter both design thinking and creative production [15].

Digital collaboration platforms may strengthen these mechanisms by making ideas visible and revisable. In a digital visual collaborative environment, Design Thinking activities were associated with creative confidence, learning motivation, and team creative performance [16]. Collaborative digital game design also supported creativity by combining authorship, peer negotiation, and iterative play [17]. A systematic review of technology-supported collaborative creativity concluded that digital tools contribute most when they structure interaction and shared production rather than simply deliver content [18]. Collaborative design can also develop digital competence because learners must coordinate, represent knowledge, and evaluate artifacts together [19]. Computer-supported collaborative learning has been linked to creativity in simulation and digital-communication courses [20]. For graphic-design education specifically, Figma provides a shared workspace for interface construction, synchronous feedback, version revision, and prototype testing; its educational use has been documented in the preparation of graphic-design students [21] and in the development of computational-thinking learning media for vocational students [22].

The vocational context nevertheless introduces access, capability, and equity concerns. Vocational teachers' digital competence varies substantially and is shaped by both individual and institutional conditions [23], while students' digital competence is influenced by learning opportunities, prior experience, and the support available in basic vocational training [24]. Gendered patterns in digital teaching competence have also been identified in dual vocational education [25]. More generally, digital-equity mindsets require educators to consider who can access devices, participate confidently, receive feedback, and convert digital participation into learning benefits [26]. Teachers' perceptions and practices can reproduce or reduce gender gaps in digital skills [27]. These concerns align with the journal's emphasis on education systems, human-centered technologies, and equitable welfare outcomes: a digitally innovative lesson is not inclusive merely because a platform is available.

Indonesian vocational research provides encouraging but fragmented evidence. Project-based learning has differentiated creative-thinking outcomes in software-development subjects [28], improved learning and creative thinking in computer numerical control [29], and supported creative-economy competence in vocational schools [30]. Design Thinking has been applied to vocational environmental-awareness projects [31], combined with project-based learning to strengthen creative thinking [32], and adapted for differentiated teacher education [33]. Related Indonesian studies have also documented technology-mediated learning through STEM e-modules [34], an e-learning module for digital literacy [35], Smart Apps Creator media [36], critical-collaborative learning [37], and mobile learning [38]. Collectively, these studies support digitally mediated active learning, but they do not explain how a collaborative interface-design platform and a complete Design Thinking cycle function together in an Indonesian vocational software-engineering classroom.

This study therefore evaluated Design Thinking and Figma-supported learning among Grade XI Software Engineering students at State Vocational High School 1 Narmada. It addressed two questions: (1) whether the experimental class achieved a higher reported posttest creative-thinking mean than the conventionally taught control class, and (2) whether the reported construct-level evidence supported a positive relationship between participation in Design Thinking and Figma-supported learning and creative thinking. The study contributes context-specific evidence for vocational pedagogy, treats the digital platform as part of a human-centered learning system rather than a neutral tool, and identifies the equity evidence required for responsible scaling. The hypothesis was that Design Thinking and Figma-supported learning would be positively related to students' creative-thinking skills.

METHODS

Research Design and Analytical Scope

The study used a quantitative quasi-experimental pretest-posttest control-group design. Two intact Grade XI classes were assigned to different instructional conditions: Design Thinking with Figma support and conventional instruction. The primary inferential analysis compared posttest creative-thinking performance between the two classes. Complementary pooled construct-level diagnostics and a structural estimate were also available for all 60 participants. These analyses address different questions and are therefore interpreted separately.

The between-class comparison assesses whether the instructional conditions were associated with different posttest outcomes, whereas the pooled structural analysis assesses the relationship between the learning construct and creative thinking. Because complete pretest statistics, group standard deviations, confidence intervals, and the exact t statistic were unavailable, causal claims are avoided and interpretation is restricted to the statistics reported in the study output.

Research Setting, Participants, and Sampling

The research was conducted at State Vocational High School (Sekolah Menengah Kejuruan Negeri, SMKN) 1 Narmada during the second semester of the 2025/2026 academic year. The population comprised Grade XI students in the Software Engineering program. Cluster random sampling was used to select two intact classes with relatively similar reported characteristics. The final sample consisted of 60 students: 30 in the experimental class and 30 in the control class. Participants were actively involved in digital-design learning and had basic computer experience. Participant-level demographic distributions were unavailable; consequently, the analyses could not be disaggregated by gender, socioeconomic status, disability, or prior digital access.

Instructional Conditions

The experimental class learned through the five Design Thinking stages. During empathize, students examined needs and user perspectives relevant to the design task. During define, they articulated the design problem and its constraints. During ideate, they generated alternative visual solutions. During prototype, they developed initial poster designs in Figma. During test, they reviewed emerging products, received feedback, and revised their designs. Figma served as a shared visual workspace for discussion, real-time editing, feedback, and iterative revision. The control class received conventional instruction. Both classes completed pretest and posttest assessments; however, complete pretest summary statistics were unavailable in the final analytical record.

Measures and Data Collection

Data were collected using a project-assessment instrument and a creative-thinking questionnaire administered in printed or digital form according to instructional needs. The questionnaire used a five-point response scale from 1 (strongly disagree) to 5 (strongly agree). The learning construct was represented by empathize, ideate, and prototype indicators, while creative thinking was represented by fluency, flexibility, originality, and elaboration. Table 1 summarizes the operational definitions used for the reported constructs and indicators.

Table 1. Operational definitions of the reported constructs and indicators

Construct	Indicator	Operational meaning
Design Thinking and Figma-supported learning	Empathize	Understanding users' needs and problems
	Ideate	Generating multiple creative ideas
	Prototype	Developing an initial visual-design draft
Creative thinking	Fluency	Generating numerous relevant ideas
	Flexibility	Approaching a problem from different perspectives
	Originality	Producing distinctive ideas
	Elaboration	Developing ideas in detail

Data Analysis

The analysis comprised data screening, descriptive statistics, instrument assessment, assumption testing, and inferential analysis. IBM SPSS Statistics was used for screening, the Shapiro-Wilk normality test, Levene's homogeneity test, descriptive statistics, and the independent-samples t test. The available analysis output indicated no missing data or influential outliers and that parametric assumptions were satisfied, although the exact assumption-test statistics were unavailable. The primary between-group comparison therefore reports the available group sizes, posttest means, and p value. A reported significance value of 0.000 is presented as $p < 0.001$ in accordance with statistical reporting conventions.

The complementary construct assessment examined indicator loadings, Cronbach's alpha, composite reliability, average variance extracted (AVE), the Fornell-Larcker criterion, variance inflation factor (VIF), the standardized path coefficient, f^2, and R^2. Confirmatory composite assessment provides a basis for evaluating measurement quality in partial least-squares structural equation modeling (PLS-SEM) [39]. PLS-SEM has also been used to explain learning outcomes in blended environments [40] and validate vocational-education competency models [41]. These statistics are reported as originally calculated because the de-identified row-level data and original model file were unavailable for reanalysis.

Ethical Considerations

Participation was voluntary. Students were informed about the purpose of the study before data collection, and confidentiality was maintained. The information obtained was used for academic purposes, and personally identifying student information was not disclosed. The study was conducted with permission from the school administration and the relevant subject teacher. No ethics-committee reference number was available for this study, and none has been retrospectively created for this article.

RESULTS AND DISCUSSION

Results

Posttest Performance by Instructional Condition

All 60 cases were retained for analysis. The experimental class had a posttest mean of 76.27, compared with 63.03 in the control class, an absolute difference of 13.24 points. The between-group difference was statistically significant ($p < 0.001$; Table 2). Group standard deviations, the exact t statistic, degrees of freedom, and the confidence interval were unavailable and are therefore not reported.

Table 2. Reported posttest creative-thinking outcomes by class

Instructional condition	n	Posttest mean	Reported significance
Design Thinking and Figma	30	76.27	$p < 0.001$
Conventional instruction	30	63.03	

Note. Group standard deviations, the exact t statistic, degrees of freedom, and the confidence interval were unavailable in the analytical output.

Construct and Indicator Profiles

On the five-point scale, the mean for Design Thinking and Figma-supported learning was 3.88 (SD = 0.56), while the creative-thinking mean was 3.91 (SD = 0.53). At the indicator level, ideate had the highest mean within the learning construct (M = 3.95), and flexibility had the highest mean within creative thinking (M = 4.02). Originality was the lowest creative-thinking indicator (M = 3.79), although it remained above the scale midpoint. Table 3 presents the full descriptive profile. The pattern suggests that students reported greater ease in varying approaches and elaborating ideas than in producing distinctly original ideas.

Table 3. Descriptive statistics for constructs and indicators

Construct	Indicator or level	Mean	SD
Design Thinking and Figma-supported learning	Overall construct	3.88	0.56
	Empathize	3.92	0.62
	Ideate	3.95	0.60
	Prototype	3.81	0.64
Creative thinking	Overall construct	3.91	0.53
	Fluency	3.88	0.61
	Flexibility	4.02	0.58
	Originality	3.79	0.67
	Elaboration	3.95	0.60

Note. Scale range: 1-5. Construct-level minima and maxima were 2.25-4.95 for Design Thinking and Figma-supported learning and 2.30-5.00 for creative thinking.

Measurement Quality

The standardized loadings ranged from 0.73 to 0.89. Cronbach's alpha was 0.88 for Design Thinking and Figma-supported learning and 0.90 for creative thinking. Composite reliability values were 0.91 and 0.93, and AVE values were 0.63 and 0.67, respectively (Table 4). These values indicate acceptable internal consistency and convergent validity within the reported measurement model.

Table 4. Reported indicator loadings and construct reliability

Construct	Indicator	Loading	Alpha	CR	AVE
Design Thinking and Figma-supported learning	Empathize	0.82	0.88	0.91	0.63
	Ideate	0.85			
	Prototype	0.78			
Creative thinking	Fluency	0.81	0.90	0.93	0.67
	Flexibility	0.89			
	Originality	0.73			
	Elaboration	0.85			

Note. CR = composite reliability; AVE = average variance extracted. Values are reported from the study's analytical output.

The Fornell-Larcker matrix showed square roots of AVE of 0.79 for Design Thinking and Figma-supported learning and 0.82 for creative thinking, both larger than the inter-construct correlation of 0.61 (Table 5). This pattern supports discriminant validity within the reported model.

Table 5. Reported Fornell-Larcker criterion

Construct	Design Thinking and Figma	Creative thinking
Design Thinking and Figma-supported learning	0.79	
Creative thinking	0.61	0.82

Note. Diagonal entries are the reported square roots of AVE; the off-diagonal entry is the reported inter-construct correlation.

Structural Estimate

The structural model showed no collinearity concern for the single predictor (VIF = 1.00). Design Thinking and Figma-supported learning had a positive standardized relationship with creative thinking (beta = 0.61, $p < 0.001$). The effect size was $f^2 = 0.59$, and the model accounted for 37% of the variance in creative thinking ($R^2 = 0.37$; Table 6). These results support the stated hypothesis within the pooled construct model and should be interpreted as associational evidence.

Table 6. Reported structural-model results

Path	Beta	t	p	f^2	R^2	VIF
Design Thinking and Figma -> creative thinking	0.61	12.84	< 0.001	0.59	0.37	1.00

Note. Beta = standardized path coefficient; f^2 = reported effect size; R^2 = explained variance; VIF = variance inflation factor.

Discussion

The experimental class achieved a higher posttest mean than the conventionally taught class. The 13.24-point difference is educationally notable, but its precision cannot be determined without group dispersion statistics and a confidence interval. The evidence therefore supports a between-class difference while warranting caution in causal generalization. This interpretation is consistent with research that frames Design Thinking as a constructivist sequence through which students make problems visible, test ideas, and revise solutions [1], [7], [11].

The indicator pattern helps explain how the learning environment may have worked. Ideate was the strongest reported indicator of the learning construct, while flexibility was the highest creative-thinking indicator. Design Thinking requires learners to postpone premature closure, generate alternatives, and move between user needs and feasible responses. This process corresponds to the productive use of uncertainty described by Beghetto [2] and to evidence that visual creativity depends on both divergent and convergent processes [6]. The relatively lower originality mean suggests that generating several approaches was easier than producing ideas perceived as distinctly novel. Teachers may therefore need to strengthen stimulus variation, analogy, critique protocols, and opportunities for independent experimentation rather than evaluating only polished final products.

Figma's contribution is best understood as a set of collaboration affordances. Shared canvases allow students to externalize tentative ideas, compare alternatives, annotate designs, and revise prototypes without losing earlier versions. These functions can support creative confidence and team performance when they are integrated with a purposeful Design Thinking sequence [16]. They also reflect the wider evidence on technology-supported collaborative creativity [18] and computer-supported collaborative learning [20]. The platform itself is not the treatment in isolation; pedagogical value arises from the interaction among task design, peer feedback, teacher facilitation, and the visibility of revisions.

For vocational education, this integration connects technical production with human-centered judgment. Software Engineering students do not only need to operate design tools; they need to understand users, communicate design rationales, and decide which solution best fits constraints. That emphasis aligns with human-centered design [14] and with studies showing that digital competence in vocational education depends on contextual support, not merely individual familiarity with devices [23], [24]. The implication for school leaders is that scaling the approach requires reliable access, teacher preparation, assessment rubrics that value process as well as product, and protected time for feedback and iteration.

The study also has implications for educational equity and social welfare. Digital learning can widen participation when students can contribute through shared artifacts and multiple modes of expression, but it can also reproduce differences in device access, confidence, and prior experience. Evidence on gender and digital competence in vocational education [25], digital-equity mindsets [26], and gendered digital-skills practices [27] shows why implementation should be monitored by subgroup. The present dataset does not contain gender-disaggregated or socioeconomic results, so it cannot establish equitable impact. A responsible contribution to Sustainable Development Goal 4 is therefore not simply the use of Figma; it is the design of an inclusive learning system in which access, participation, feedback, and outcomes are examined together.

The construct-level analysis provides complementary evidence. The positive beta and R^2 show that the learning construct was related to creative thinking, while the reported reliability and validity statistics support the internal coherence of the measurement model. However, the small single-site sample and the absence of row-level data and the original model file limit independent verification. The structural coefficient should therefore not be treated as a separate replication of the between-class result. Rather, it indicates consistency between students' experience of the Design Thinking-Figma process and their creative-thinking profile. Future studies should preregister the primary outcome, retain complete pretest and posttest statistics, report confidence intervals and effect sizes, distinguish individual from class-level allocation, and evaluate measurement invariance across relevant learner groups.

Taken together, the findings support a practical instructional sequence: begin with a user-centered problem, require multiple ideas before selection, use Figma to make reasoning and revision visible, structure peer critique around explicit creative-thinking criteria, and assess both the design process and the final artifact. This sequence is consistent with Indonesian project-based vocational learning [28], [29], [30], Design Thinking applications [31], [32], [33], and technology-mediated learning studies [34], [35], [36], [37], [38]. Its contribution lies in integrating these strands within a single learning environment while keeping claims proportionate to the available evidence.

CONCLUSION

The Design Thinking and Figma-supported learning condition was associated with a higher posttest creative-thinking mean than conventional instruction among 60 Grade XI Software Engineering students at State Vocational High School 1 Narmada. The construct-level results were also internally coherent: indicator loadings, reliability, convergent validity, discriminant validity, and the positive structural estimate supported the proposed relationship. The instructional value of the approach lies in combining user-centered problem framing, divergent ideation, visible prototyping, and iterative peer feedback within a shared digital workspace. In practice, vocational schools can use this approach to connect technical design skills with creativity, collaboration, and user awareness. Responsible scaling requires teacher preparation, equitable access, complete outcome reporting, and subgroup analysis so that digital innovation contributes to inclusive quality education rather than merely increasing technology use.

LIMITATIONS

The study was conducted in one vocational school with two intact classes and a total sample of 60 students, limiting generalizability. Complete pretest statistics, group standard deviations, the exact t statistic, degrees of freedom, confidence intervals, and a standardized between-group effect size were unavailable and were not reconstructed. The original model file and de-identified row-level data were also unavailable, preventing independent reproduction of the construct-level analysis. The questionnaire and project assessment may capture overlapping but not identical dimensions of creativity. In addition, the absence of gender, socioeconomic, disability, and digital-access disaggregation prevents assessment of differential or equitable effects. Multi-site studies should preserve complete statistical output, account for baseline performance and class clustering, combine product-based and process-based creativity measures, and test whether benefits are consistent across learner groups.

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AUTHOR CONTRIBUTION

S. conceptualization, methodology, investigation, data curation, formal analysis, and writing-original draft. A.R. supervision, theoretical validation, and writing-review and editing. H. interpretation, academic validation, and writing-review and editing. All authors reviewed and approved the final manuscript and accept responsibility for the published work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

During manuscript revision, ChatGPT (OpenAI) was used solely for language polishing, structural consistency checks, and reference-format verification. All scientific content, analyses, interpretations, and citations were reviewed and approved by the authors, who remain fully responsible for the final manuscript.

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