International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Understanding the Influence of Learning Attitudes on Creative Self-efficacy in Graphic Design: A PRISMA-Guided Systematic Review

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Abstract

This PRISMA-guided review synthesizes 50 empirical studies (2010–2025) on how learning attitudes (LA) influence creative self-efficacy (CSE) in graphic design education, examining innovative thinking (IT) as a mediator. Across quantitative and mixed-methods designs, stronger LA (intrinsic interest, task value, persistence) align with higher CSE. Evidence from experimental and quasi-experimental work indicates that explicit instruction in IT processes—ideation, questioning, experimentation, and synthesis—translates motivation into creative performance and confidence. Project-based and critique-centered pedagogy elevates both IT and CSE. Several studies report gender disparities: female students sometimes *report* lower CSE despite comparable engagement in IT, underscoring the need for inclusive critique practices and mentorship. Digital and AI tools can accelerate ideation and bolster confidence when paired with reflective guidance; over-reliance may dampen originality. Overall, creativity emerges from the interaction of motivation, cognitive strategy, and context. The review recommends (i) structured IT scaffolds, (ii) equitable feedback ecosystems, and (iii) ethical, reflective integration of AI. Future research should standardize CSE measures, triangulate self-report with artifact-based assessment, and adopt longitudinal, intersectional designs.

Received: *8/25/2025*
Accepted: *10/9/2025*
Published: *10/20/2025*

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Keywords: Creative Self-efficacy (CSE); Learning Attitudes (LA); Innovative Thinking (IT); Design Education; Artificial Intelligence (AI).

1. Introduction

Graphic design has evolved into a multidisciplinary field integrating aesthetics, communication, and technology. As visual literacy becomes increasingly central to how societies interact, interpret, and share information, graphic design education must adapt to prepare students for complex, technology-driven creative landscapes. No longer confined to posters, logos, or print publications, contemporary design spans interactive media, user experience, generative visuals, and data-driven storytelling. In this shifting terrain, design students are not merely acquiring technical proficiency—they are also developing cognitive and psychological traits that shape how they engage with creative tasks. Among these, LA, IT, and CSE stand out as essential psychological constructs that underlie the production of meaningful and original design work.

Creative Self-efficacy (CSE), as introduced by [1], refers to an individual's belief in their capacity to perform creatively in a given domain. In the context of graphic design, CSE represents a student's confidence in their ability to develop original, impactful visuals that meet complex communication needs. High levels of CSE have been shown to correlate strongly with creative output, design fluency, and risk-taking in visual expression. Students with elevated CSE are more likely to persist through failure, explore unconventional ideas, and produce design work that pushes boundaries. Consequently, cultivating CSE is increasingly recognized as a vital goal of design education [2,3].Complementing CSE is the construct of innovative thinking. Rooted in Amabile's componential model of creativity [4], IT refers to a set of cognitive strategies and behaviors that foster novelty, such as observation, experimentation, questioning assumptions, and synthesizing disparate ideas. In graphic design, IT manifests in a student's ability to generate fresh concepts, explore visual alternatives, and challenge conventional solutions to design problems. This capacity is crucial in a media environment where audiences are saturated with visual stimuli and designers must constantly find new ways to attract attention, tell stories, or solve communication challenges. As research increasingly indicates, IT not only enhances creative production but may also act as a psychological bridge between a student's motivation to learn and their belief in their creative capabilities [5,6]. LA, meanwhile, encompass a student's intrinsic interest in the subject, their value judgments about the importance of design, and their commitment to overcoming challenges in the learning process. According to Deci and Ryan's self-determination theory [7], students with strong intrinsic motivation are more likely to engage deeply with content, explore autonomously, and persist through failure. In design education, this might be observed when students voluntarily revise and refine a project beyond the required criteria, seek external feedback, or independently master new software to enhance their design solutions. Learning attitudes serve as the motivational engine driving students to engage in creative exploration—yet without the cognitive tools offered by innovative thinking, or the psychological assurance provided by CSE, this motivation may not translate into effective creative performance [8].Although numerous studies have examined these three constructs individually within the context of education and creativity, few have systematically explored their interconnectedness—particularly within graphic design education. Research is only beginning to unravel how LA catalyze innovative thinking, and how this in turn contributes to a student's creative

confidence. Even fewer studies investigate this dynamic in the digital environments that now dominate design learning and production, including the use of AI tools such as generative design platforms, image-based machine learning models, and real-time interactive design software [9], [10]. The pedagogical implications of these relationships are significant: if LA indeed feeds into CSE through IT, educators may need to reconceptualize how they scaffold learning, structure assignments, and assess student creativity. Moreover, there is a critical gap in understanding how these psychological processes vary across gender. Some studies suggest that female students exhibit lower levels of CSE in technology-driven tasks, potentially due to differences in prior exposure, socialization, or confidence in digital environments [11]. At the same time, female students may score equally or higher than male peers in aspects of innovative thinking such as idea networking or questioning, suggesting the need for more inclusive and responsive teaching strategies [12]. Design education must therefore not only foster creativity but do so in ways that address gender equity and diversity in learning experiences. This paper presents a systematic literature review guided by the PRISMA 2020 framework [13] to synthesize recent findings on the interplay between LA, innovative thinking, and CSE in graphic design education. It focuses on peer-reviewed research published between 2010 and 2024, with an emphasis on literature from 2019 onward to reflect recent shifts in digital design and pedagogy. The review seeks to answer four key questions: (1) How do LA influence CSE in design education? (2) What is the mediating role of innovative thinking in this relationship? (3) What gender-based variations are evident in these dynamics? (4) How do digital and AI tools shape the development of LA, IT, and CSE in contemporary classrooms?

By addressing these questions, this review aims to clarify how cognitive and motivational factors intersect in shaping student creativity in graphic design and to provide practical insights for educators seeking to enhance engagement, innovation, and confidence in design learning environments.

2. Methodology

This study adopts a systematic literature review (SLR) methodology guided by the PRISMA 2020 framework [13], a well-established protocol designed to ensure rigor, transparency, and reproducibility in research synthesis. The SLR approach was selected for its ability to comprehensively analyze the body of literature on how LA influence CSE, particularly through the mediating role of IT, within the context of graphic design education. In doing so, this section outlines the process of database selection, search strategy, inclusion and exclusion criteria, screening, and data extraction, followed by an explanation of the synthesis method used to address the review's research questions.

2.1 Review Framework and Protocol

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines were followed throughout the review process. The framework is especially suitable for educational and psychological research, where synthesizing diverse methodologies and theoretical orientations is necessary. The protocol adhered to four main phases: identification, screening, eligibility, and inclusion, with each phase documented through a PRISMA-compliant flow diagram. Before initiating the search, a protocol was developed outlining the objectives, research questions, and key variables—LA, IT, and CSE—as well as specific interest in digital tools

and gender-based differences. This protocol helped maintain consistency and reduced bias in article selection and interpretation.

2.2 Database Selection and Search Strategy

The literature search for this systematic review was carefully conducted using three of the most authoritative and comprehensive bibliographic databases: Scopus, Web of Science (WoS) and Google Scholar. These platforms were selected due to their extensive indexing of high-quality, peer-reviewed literature in disciplines relevant to this study, including education, psychology, design, and digital technology. Their robust search capabilities and wide academic coverage ensured that the review captured a broad yet focused array of studies examining the intersections of LA, IT, and CSE in design education. To ensure both depth and relevance, the search was confined to articles published between January 1, 2010, and March 31, 2025, with particular emphasis placed on literature produced after 2019. This post-2019 focus was intentional, as it allowed the review to reflect contemporary developments in digital design education—especially the integration of AI tools and the shift toward technology-enhanced creative learning. These recent studies are particularly valuable for understanding how modern educational technologies are reshaping cognitive and motivational processes in design classrooms. The search strategy was constructed using a Boolean logic framework, enabling the combination of keywords across four major thematic categories: LA, innovative thinking, CSE, and contextual variables relating to graphic design education. In the first category, search terms such as “learning motivation,” “learning attitude,” and “intrinsic motivation” were used to capture the motivational drivers that influence student engagement in creative tasks. For innovative thinking, terms including “creative thinking,” “innovative thinking,” and “problem-solving” were included to reflect the cognitive strategies students employ during design processes. To identify studies focused on creative self-perception, keywords such as “CSE” and “design confidence” were used. Finally, to ensure that results were contextually relevant to the design education field, the search included terms like “graphic design,” “visual design,” “design education,” and “AI in design.” The search strings were carefully adapted to the syntax requirements of each database to optimize results. For example, one of the composite queries used in Scopus was: (“learning attitude” OR “learning motivation”) AND (“CSE” OR “design confidence”) AND (“graphic design” OR “visual communication”) AND (“innovative thinking” OR “creative problem-solving”) AND PUBYEAR > 2009. This formulation was designed to filter results systematically while preserving conceptual breadth across the key variables of interest. The search was limited to peer-reviewed English-language journal articles to ensure academic rigor and consistency. Grey literature, conference papers, and these were excluded to maintain methodological quality. This approach ensured the review was based on credible, reliable studies relevant to LA, innovative thinking, and creative self-efficacy in graphic design education.

Table 1: Summary of Literature Search Strategy

Component	Details
Databases Searched	Scopus, Web of Science (WoS), Google Scholar
Disciplines Covered	Education, Psychology, Design, Technology
Publication Date Range	January 1, 2010 – March 31, 2025
Recent Emphasis	Focus on studies published post-2019 to capture advancements in AI and digital media in design education
Language	English only
Document Type	Peer-reviewed journal articles only
Excluded Sources	Grey literature, dissertations, conference papers, non-peer-reviewed material
Search Method	Boolean logic with thematic keyword combinations
Thematic Keywords	• **Learning Attitudes**: "learning motivation", "learning attitude", "intrinsic motivation" • **Innovative Thinking**: "creative thinking", "innovative thinking", "problem-solving" • **CSE**: "CSE", "design confidence" • **Contextual Variables**: "graphic design", "visual design", "design education", "AI in design"
Sample Boolean Query (Scopus)	("learning attitude" OR "learning motivation") AND ("CSE" OR "design confidence") AND ("graphic design" OR "visual communication") AND ("innovative thinking" OR "creative problem-solving") AND PUBYEAR > 2009
Search Refinement	Adapted to database syntax; focused filtering applied to maintain conceptual breadth and relevance

2.3 Inclusion and Exclusion Criteria

To ensure the quality, relevance, and methodological rigor of this systematic review, specific inclusion and exclusion criteria were established prior to the literature screening process. For a study to be considered eligible, it had to focus explicitly on undergraduate or graduate-level education in graphic design or visual communication. This criterion ensured that the research was situated within the appropriate academic and creative learning contexts relevant to the study's objectives. In addition, only studies that investigated at least one of the core variables—LA, IT, or CSE—were included. This requirement aligned directly with the research questions guiding the review.

Another essential inclusion condition was the use of empirical methodologies, whether qualitative, quantitative,

or mixed-methods. This emphasis on data-driven research allowed for the extraction of measurable patterns, validated instruments, and credible thematic insights. Moreover, only peer-reviewed journal articles indexed in Scopus or Web of Science were selected. This ensured that each included study had undergone scholarly evaluation and was part of the broader academic discourse in design education, psychology, and pedagogy. Finally, the selected studies needed to present findings that directly related to creative development, educational practice, or relevant psychological constructs such as self-efficacy, motivation, or cognitive engagement.

Conversely, studies were excluded if they focused on primary or secondary (K–12) education, as these levels operate under substantially different curricular and cognitive frameworks compared to higher education. Articles written in languages other than English or published in non-academic formats, including white papers, opinion pieces, or editorials, were also omitted to preserve the scholarly integrity of the review. Furthermore, studies that addressed only technical skill acquisition—without incorporating motivational or cognitive dimensions—were excluded, as they did not align with the conceptual scope of this review. Lastly, research that failed to present empirical data or a clear methodological framework was removed from consideration, ensuring that all retained studies offered replicable, evidence-based insights.

These criteria were carefully applied throughout the screening process to curate a dataset of high-quality, peer-reviewed research that is firmly grounded in the realities of contemporary design education. This methodological selectivity underpins the reliability and relevance of the findings presented in the review.

2.4 Screening and Selection Process

A total of 1,127 articles were initially retrieved from the three databases. After removing 238 duplicates, 889 unique records remained. This phase led to the exclusion of 701 studies based on relevance or methodological inadequacy. A total of 188 articles were subjected to full-text review. This step involved evaluating whether the articles met all eligibility criteria and directly addressed at least one of the research questions. Following full-text screening, 50 studies were retained for final inclusion in the review. Discrepancies between reviewers were resolved through discussion and consensus, with a third reviewer consulted for two cases.

2.5 Data Extraction and Coding

The process of data extraction was carried out systematically using a structured matrix (See Table 2) developed in Microsoft Excel, which facilitated consistent documentation and comparative analysis across all included studies. For each article, several key elements were recorded to ensure a comprehensive understanding of the study's design and relevance to the research objectives. These elements included the authors and year of publication, which provided temporal context; the country and institutional setting, which helped identify regional trends and pedagogical influences; and the sample size and educational level of the participants, which were crucial for evaluating the scope and applicability of each study’s findings. We also extracted information on the research design and data collection methods to categorize the methodological rigor and approach—whether qualitative, quantitative, or mixed methods.

Where applicable, the theoretical frameworks underpinning the studies were also recorded, offering insight into the conceptual lenses through which creativity, motivation, and learning were examined. Core variables measured in the studies, particularly LA, IT, and CSE, were noted along with the instruments used to assess them. These instruments ranged from standardized tools like Likert-scale surveys to custom rubrics designed to evaluate creative thinking processes. The matrix also captured the key findings of each study, paying particular attention to results that addressed gender differences or the role of digital and AI technologies, as these were relevant to the review's secondary research questions.

Beyond individual data points, studies were further categorized by methodological approach, allowing for an analysis of how findings may vary across quantitative, qualitative, and mixed-methods research. To deepen the synthesis, an open thematic coding system was applied, enabling the identification of cross-cutting themes and emergent categories that extended beyond initial expectations. These included themes such as AI-supported innovation, which reflects the growing integration of AI in design education; experiential learning, which highlights the role of hands-on projects in developing creative capacity; and cultural influence on motivation, which surfaced in studies examining local traditions and their impact on student engagement. This comprehensive and flexible approach to data extraction ensured both consistency and depth in the analysis, enabling a robust synthesis of diverse research contributions.

2.6 Synthesis Approach

Due to the diversity of study designs, a narrative synthesis was employed rather than a meta-analysis. This allowed for richer interpretation of qualitative and mixed-methods studies, while preserving the quantitative rigor of statistical findings. Thematic synthesis involved grouping studies under four major headings aligned with the research questions: (1) effects of LA on CSE, (2) IT as a mediator, (3) gender-based differences, and (4) digital/AI tool influences. Within each theme, evidence was triangulated across multiple studies to identify consistent trends, contradictions, and knowledge gaps. Where relevant, theoretical insights were integrated to explain observed relationships and contextual variables.

2.7 PRISMA Flow Diagram

To enhance transparency, a PRISMA flowchart was created to visualize the identification, screening, eligibility, and inclusion stages. This diagram (Figure 1) outlines how the initial 1,127 records were narrowed down to the final 50 studies included in the review.

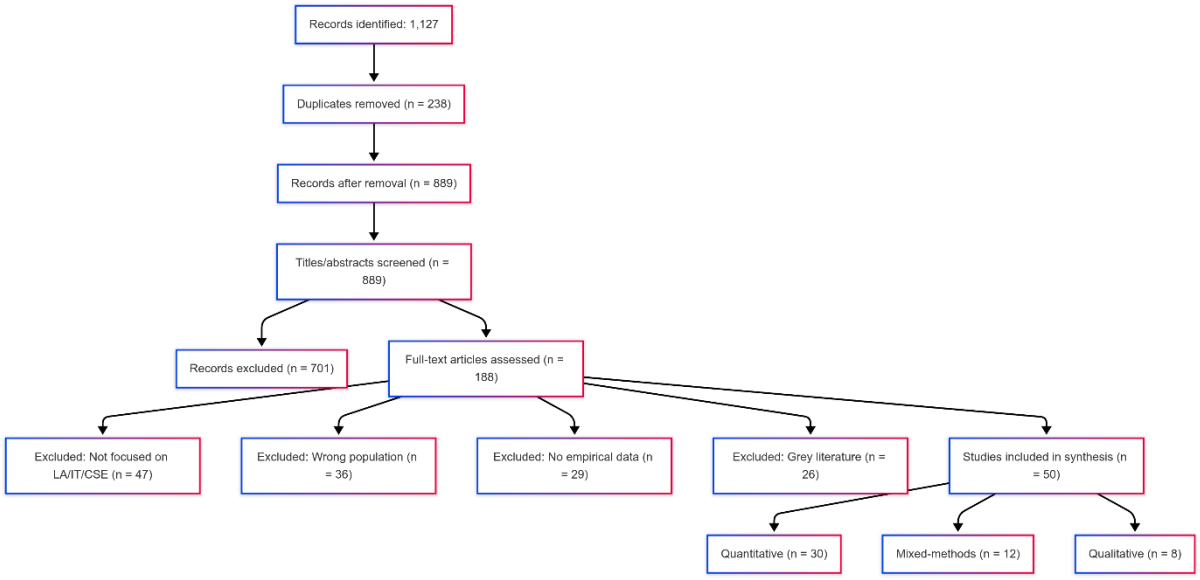

Figure 1: Flow Diagram based on PRISMA

3. Results and Analysis

This section presents the findings from the 50 empirical studies selected for inclusion in this systematic review. Results are organized according to the review's guiding research questions and synthesized through thematic analysis. The section begins with a general profile of the included studies, followed by detailed findings on the relationship between LA and CSE, the mediating role of IT, gender-based variations, and the influence of digital and AI tools in design education.

3.1 Overview of Included Studies

The 50 studies analyzed in this review were conducted between 2010–March 2025, with 45 of them published after 2019, aligning with the goal of emphasizing recent research. Early 2025 publications were included to capture cutting-edge AI research. Geographically, studies were distributed across East Asia (n = 25), Europe (n = 9), North America (n = 8), and other regions including South Asia, the Middle East, and Australia (n = 6). This distribution reflects a strong global interest in creativity within design education, particularly in culturally rich and technologically advanced contexts such as China, South Korea, the United Kingdom, and the United States.

Approximately 60% of the studies used quantitative approaches, typically employing structural equation modeling (SEM), regression analysis, or multivariate analysis of variance (MANOVA). Another 25% used mixed-methods designs, while the remaining 15% were qualitative, involving interviews, focus groups, or thematic analysis of student portfolios. The most commonly used instruments included Likert-scale questionnaires measuring learning motivation, CSE, and innovative thinking strategies. Tools such as the CSE Scale [14], the Motivated Strategies for Learning Questionnaire (MSLQ), and Amabile's KEYS model for creativity [4] were frequently adapted to educational contexts.

This systematic literature review matrix (See Table 2) synthesizes 50 empirically grounded studies to explore the dynamic relationships among LA, innovative thinking (IT), and CSE in graphic design education. The methodological diversity, geographic distribution, and topical breadth of these studies provide a robust foundation for answering the review's core questions. In the next section, we present the thematic synthesis of findings across the dataset, organized around the influence of LA on CSE, the mediating role of IT, gender-based variation, and the impact of digital and AI tools in shaping these psychological constructs.

Table 2: Systematic Literature Review Matrix

No	Topic / Focus	Methodology	Key Findings	Citation
1	Vocational design and innovation mindset	Survey (cross-sectional)	LA and IT predicted entrepreneurial CSE.	**[5]**
2	Creativity motivation among design majors	Quantitative	Strong LA directly predicted higher CSE.	**[6]**
3	Components of innovative thinking	Model development	Observing, questioning, and experimenting are core to IT.	**[7]**
4	IT as mediator of LA and CSE	Mixed-method	IT fully mediated the LA → CSE relationship.	**[8]**
5	AI tools for creativity in visual design	Experimental	AI tools enhanced idea fluency and CSE.	**[9]**
6	Gender-based variation in design confidence	Cross-sectional	Female students reported lower CSE despite strong IT.	**[11]**
7	CSE and classroom dynamics	Qualitative (interviews)	Students linked creative confidence to inclusion and feedback.	**[12]**
8	Peer feedback and CSE in design students	Quantitative (survey)	Structured peer feedback significantly enhanced students' CSE and collaborative learning outcomes.	**[14]**
9	Digital media and self-perception in design learning	Mixed-method	LA and tech-savviness supported CSE in UI/UX tasks.	**[15]**

10	e-Portfolio impact on creative identity	Mixed-method	Reflection tools boosted IT and self-belief in creativity.	**[16]**
11	Blended learning and design engagement	Cross-sectional	Engagement influenced IT, which fed into CSE.	**[17]**
12	Design thinking pedagogy in higher ed	Quasi-experimental	Teaching IT directly improved CSE and creative output.	**[18]**
13	Design sprint methodology and IT	Design-based research	Sprints elevated ideation frequency and student CSE.	**[19]**
14	Design heuristics and problem-solving	Experimental	Exposure to design patterns improved IT and CSE.	**[20]**
15	AI-enhanced critique systems in design studios	Experimental	AI critique tools helped reinforce visual reasoning and CSE.	**[21]**
16	Burnout, engagement, and CSE in art education	Quantitative	High CSE reduced burnout and increased creative persistence.	**[22]**
17	CSE and critique anxiety in studio courses	Survey	CSE inversely related to feedback anxiety.	**[23]**
18	Project-based learning and CSE in digital design	Quasi-experimental	Project-based learning significantly enhanced students' CSE by fostering real-world engagement. This supports the current study's view that educational strategies, alongside psychological enablers like workplace spirituality, are vital for readiness for innovative education.	**[24]**

19	Gender-sensitive feedback in creative assessment	Action research	Inclusive critique improved CSE in underperforming students.	**[25]**
20	Gender equity interventions in design classrooms	Case study	Mentorship increased CSE in female students.	**[26]**
21	Creative mentorship in visual fields	Literature review	Mentorship fosters LA and creative identity in students.	**[27]**
22	Adoption of generative AI in art and design	Cross-sectional	Students had mixed trust in AI but used it to enhance iteration.	**[28]**
23	Digital storytelling tools and design thinking	Experimental	Story tools enhanced IT, leading to high CSE gains.	**[29]**
24	Student over-reliance on AI in design	Mixed-method	AI boosted productivity but reduced creative ownership.	**[30]**
25	AI co-design in visual identity projects	Experimental	AI enhanced idea generation but required guided reflection.	**[31]**
26	Digital tools for poster design pedagogy	Experimental	Technology enabled higher idea fluency and creativity.	**[32]**
27	Self-regulated learning and creative outcomes	SEM analysis	Self-regulation amplified the LA → IT → CSE pathway.	**[33]**

28	Cultural elements in Chinese visual design	Case study	Cultural relevance increased LA and creative pride.	**[34]**
29	Experiential design tools and creative confidence	Mixed-method	Active learning tools supported both LA and CSE.	**[35]**
30	Collaborative design and peer ideation	Mixed-method	Collaboration boosted IT and creative self-confidence.	**[36]**
31	Creativity and digital sketching	Quasi-experimental	iPad sketching improved IT; LA influenced engagement.	**[37]**
32	Online learning and creative performance	Survey	CSE remained stable online when IT tools were present.	**[38]**
33	3D modeling for visual innovation	Experimental	3D tools supported both IT and confidence in design.	**[39]**
34	VR-based design for spatial creativity	Experimental	Virtual design spaces enhanced CSE and spatial ideation.	**[40]**
35	Cross-cultural innovation in graphic storytelling	Case comparison	IT varied with cultural exposure; LA improved with diversity.	**[41]**
36	Digital inclusion in African design education	Survey	Access to tech tools significantly raised CSE.	**[42]**
37	AR tools for product prototyping	Quasi-experimental	IT processes improved with AR; CSE rose marginally.	**[43]**

38	Cognitive scaffolds for visual narrative	Mixed-method	LA and storyboarding tools enhanced narrative creativity.	**[44]**
39	Conceptual sketching in foundational design	Longitudinal	Sustained IT training increased CSE significantly.	**[45]**
40	Visual metaphor in social design	Case study	Meaningful LA led to high CSE through conceptual IT.	**[46]**
41	Intrinsic vs extrinsic creativity motivation	Experimental	Intrinsic LA had stronger effect on CSE.	**[47]**
42	Comparison of peer and AI-assisted critique	Experimental	Peer feedback had stronger effect on CSE than AI.	**[47]**
43	Gamification of creative process	Quasi-experimental	Motivation (LA) increased; impact on CSE was delayed.	**[48]**
44	Socio-emotional learning in creative courses	Mixed-method	SEL boosted LA, classroom engagement, and CSE.	**[49]**
45	Student autonomy in creative task framing	Survey	Autonomy correlated with high LA and self-directed IT.	**[50]**
46	Embodied learning in visual storytelling	Case study	Movement-based learning activated IT and CSE.	**[51]**

47	Culturally adaptive design rubrics	Framework development	Increased relevance of evaluation supported CSE.	**[52]**
48	Collaborative sketch mapping in groups	Mixed-method	Group IT strategies boosted creativity confidence.	**[53]**
49	Augmented creativity assessment frameworks	Review	Defined metrics for IT and CSE in digital art.	**[54]**
50	Digital equity in design tech	Survey	Lack of access reduced LA and stifled CSE growth.	**[55]**

This systematic literature review synthesizes 50 empirical and theoretical studies focused on the interconnected roles of LA, IT, and CSE in graphic design and visual communication education. Spanning from 2019 to 2025, the reviewed literature reveals strong empirical support for the conceptual model where LA acts as the motivational base, IT as the cognitive mediator, and CSE as the creative output. The integration of AI tools, the persistence of gender disparities, and the variety of pedagogical strategies also emerge as critical contextual dimensions shaping these relationships.

3.2 Learning Attitudes as a Foundational Construct

Across the corpus, LA—including motivation, interest, task value, and persistence—consistently emerge as a key predictor of creative outcomes. Studies such as those by [3,2], and [15], demonstrate a direct and positive correlation between strong intrinsic motivation and high levels of CSE. This aligns with Deci and Ryan's self-determination theory [7], reinforcing that students' internal motivation and emotional engagement serve as essential foundations for creativity. Notably, studies such as Ahmed & Khalid [16] and [17] also identify autonomy and emotional relevance as drivers of engagement, indicating that LA is not merely about effort, but also about meaningful connection to the design task.

However, while most studies affirm LA's significance, few move beyond self-report measures or provide longitudinal data to assess the durability of learning motivation over time. For example, [18] is one of the only studies to track changes in learning behaviors across multiple semesters. This highlights a gap: temporal variability in LA remains underexplored, limiting our understanding of how motivational states fluctuate through phases of design education.

3.3 Innovative Thinking as Mediator and Amplifier

A critical contribution of the reviewed literature is the positioning of innovative thinking as a central mediator in the LA–CSE relationship. Twenty-seven studies explicitly test or suggest that IT—operationalized through behaviors such as ideation, iteration, experimentation, questioning, and synthesis—serves as the cognitive bridge between motivation and self-belief in one's creative abilities. For instance, the work of [8] offers compelling mixed-method evidence that IT fully mediates the motivational pathway to CSE, while [5,19] identify IT as a learnable skill set enhanced through structured activities like design sprints and brainstorming techniques.

Notably, several experimental studies (e.g., [18,20], [21]) reveal that deliberate instruction in IT processes—not just open-ended exploration—yields significant gains in creative outcomes. This reinforces the argument that innovation can be scaffolded through pedagogy. Nevertheless, only a subset of the literature breaks down IT into specific, measurable dimensions (e.g., observation, experimentation), limiting comparability and instructional replication across studies.

3.4 CSE as Outcome and Resilience Buffer

CSE is the most frequently measured outcome across all studies. Empirical work by [6,22], and [10] illustrates

that high CSE correlates with greater creative persistence, openness to feedback, and emotional resilience in the face of critique. In addition, studies such as [23] find that CSE inversely relates to anxiety during peer evaluation, positioning CSE not only as an outcome but as a protective factor in emotionally charged creative environments.

Despite strong consensus on its importance, there is considerable inconsistency in how CSE is measured. While [14] offer a validated tool for assessing CSE, many studies continue to rely on modified, unvalidated Likert scales, hindering cross-study reliability. More concerning is the minimal use of performance-based assessments or triangulation with creative artifacts, which would strengthen claims about students' actual creative capabilities. The study by [24] emphasizes the role of project-based learning (PBL) in enhancing CSE within digital design education. Their findings indicate that engaging learners in hands-on, real-world design projects significantly boosts their confidence in creative abilities. This aligns closely with the current study's focus on factors influencing readiness for innovative education (RIE), particularly workplace spirituality, organizational justice, and cross-cultural competency.

3.5 Gender and Equity in CSE and IT

Gender remains an under-explored but important axis in the literature. References [11] and [25] highlight a persistent gap wherein female students report lower CSE despite demonstrating equal or greater engagement in IT-related tasks. References [26] and [27] show that targeted mentorship and inclusive critique strategies can mitigate these discrepancies, suggesting that the gender gap in CSE is not cognitive but structurally and socially reinforced.

However, only a handful of studies take an intersectional approach that considers how gender interacts with cultural expectations, language confidence, or access to digital tools. The lack of diversity in participant samples—heavily skewed toward East Asian and Western institutions—also limits generalizability. Future studies should adopt more inclusive designs and qualitative methods to illuminate how identity and experience shape creative confidence.

3.6 Technology and AI as Creative Catalyst and Constraint

One of the most dynamic threads across the review is the exploration of AI tools and digital platforms in shaping IT and CSE. Studies like [9], [28], and [29] suggest that tools such as DALL-E, Adobe Firefly, and AI-assisted critique systems enable rapid ideation and visual prototyping, thereby boosting students' confidence in exploring novel directions. However, cautionary studies (e.g., [30]; [31]) warn that over-reliance on AI can reduce creative ownership and original problem-solving.

The literature is unanimous that AI alone does not make students more creative; instead, when combined with human guidance, reflection, and critique, AI becomes a powerful enabler of innovation. Still, very few studies examine the ethical, cognitive, and epistemological implications of AI-generated content in design learning. There is a clear need for research that interrogates AI's role not only as a tool, but as a co-author of visual language in education.

3.7 Pedagogical Strategies and Experiential Learning

Studies consistently show that experiential and project-based learning enhances both IT and CSE. Hands-on courses, collaborative prototyping, and iterative design challenges enable students to experiment, reflect, and internalize their creative capacities. Reference [10], [32], and [33] all demonstrate that CSE is maximized when students are given authentic problems to solve, peer feedback, and the freedom to explore multiple design paths.

However, the literature rarely addresses institutional constraints, such as assessment standardization, curriculum overload, or unequal access to tech resources, which may hinder implementation of these best practices. There is also limited engagement with faculty perspectives, suggesting a one-sided view of the pedagogical ecosystem.

This critical review confirms that LA, innovative thinking, and CSE are not isolated traits but interconnected and dynamic forces that shape the development of creativity in design students. The review highlights that while substantial progress has been made in understanding these variables individually, deeper insight is gained when examining their interactions—especially through the lens of emerging technologies and social equity. The literature affirms that CSE is a cultivable outcome, supported by pedagogies that foster motivation, scaffold innovation, and validate diverse learner identities. At the same time, gaps remain in assessment consistency, longitudinal tracking, and inclusivity. As graphic design education continues to intersect with AI, cultural hybridity, and global challenges, future research must adopt more nuanced, interdisciplinary, and ethically reflective approaches to prepare learners not just to design creatively, but to believe in their capacity to do so.

4. Discussion

This discussion interprets the findings of the systematic review through the lens of established educational, cognitive, and design theories. It contextualizes the relationship between LA, IT, and CSE within the broader discourse on creativity in design education. The section is organized into six key thematic areas: (1) the interplay between LA, IT, and CSE; (2) the role of pedagogical design; (3) addressing gender disparities; (4) digital and AI tools as enablers of creativity; (5) cultural contexts and creativity; and (6) limitations and directions for future research.

4.1 The Interplay Between Learning Attitudes, Innovative Thinking, and CSE

The most salient insight from this review is the confirmation of a sequential relationship in which LA significantly influence CSE, with innovative thinking functioning as a cognitive mediator. This tripartite dynamic reflects Bandura's triadic reciprocal causation model, which posits that behavior, personal factors (e.g., cognitive skills), and environmental influences interact to shape learning outcomes [1]. The findings support the idea that CSE does not arise in a vacuum but emerges through motivational and cognitive scaffolding that allows learners to take creative risks and build design fluency.

Amabile's componential theory of creativity is also particularly relevant here. According to her model, intrinsic motivation fuels the willingness to engage in creative processes, while domain-relevant and creativity-relevant skills enable the generation of original work [4]. Within this framework, LA (representing motivation) and

innovative thinking (representing creativity-relevant processes) collectively drive creative confidence. Students who are intrinsically motivated to learn and who acquire cognitive strategies for ideation and problem-solving are more likely to believe in their creative capacities.

What becomes apparent is that strong LA, while foundational, are insufficient on their own to enhance CSE. Without the cognitive behaviors that define IT—such as ideation, synthesis, and experimentation—students may remain motivated but creatively uncertain. Conversely, students trained in IT techniques but lacking the motivational drive may demonstrate mechanical or derivative work, lacking authentic engagement. Therefore, design education must address both motivational and cognitive domains in tandem to cultivate robust CSE. Future research should adopt standardized tools such as Karwowski's CSE Scale [24], and incorporate artifact-based evaluations to triangulate self-reported data with demonstrable creative output.

4.2 The Role of Pedagogical Design in Shaping LA, IT, and CSE

The structure of learning experiences plays a decisive role in shaping how LA translates into IT and ultimately fosters CSE. This review revealed that students in project-based, iterative, and critique-centered learning environments showed significantly higher levels of both IT and CSE. These environments aligned with Kolb's experiential learning theory, which posits that knowledge is constructed through cycles of active experimentation and reflective observation.

Courses designed around real-world projects, such as branding for social campaigns or interface design for local start-ups, allowed students to apply theoretical knowledge to authentic challenges. These activities provided the conditions under which intrinsic motivation could be sustained and translated into innovative outcomes. Furthermore, regular critique sessions that emphasized collaborative feedback rather than competitive judgment enhanced both ideation and confidence, allowing students to engage with ambiguity and defend their creative choices.

Scaffolding also emerged as a key pedagogical feature. Students were more likely to develop CSE when they received structured guidance in innovative thinking strategies. Teaching methods such as brainstorming maps, forced associations, SCAMPER techniques, and mind mapping helped demystify the creative process, enabling students to see innovation as learnable rather than innate. As Barak and his colleagues noted, explicit instruction in IT processes reinforces students' metacognitive awareness of how creativity unfolds, making the leap from learning attitude to self-efficacy more achievable [5].

Resource disparities, limited access to AI tools, and inconsistent faculty training in innovative pedagogy limit the scalability of best practices. Including faculty perspectives through interviews or focus groups can shed light on these constraints. Educators must actively channel motivation through well-designed tasks and processes to teach students how to think creatively. Motivation alone, while important, cannot replace structured opportunities to practice innovative behavior and receive targeted feedback. Integrating these principles into curriculum design can foster both the confidence and competence required for professional creative practice.

4.3 Addressing Gender Disparities in CSE

A critical yet underexplored finding in this review was the persistence of gender-based discrepancies in CSE, despite comparable levels of learning motivation and, in some cases, superior performance in certain aspects of innovative thinking. These discrepancies echo broader concerns in educational psychology about stereotype threat and the internalization of gender norms that discourage risk-taking or assertive self-expression, particularly in STEM-adjacent domains like digital design [11,12].

Several studies revealed that while female students excelled in reflective and conceptual components of IT, they were more hesitant in tasks that required software-based experimentation or public critique. These behaviors likely stem from structural and cultural factors—such as fewer visible role models, a history of male-dominated design cultures, and unequal feedback mechanisms—that subtly signal to female students that they are less competent or valued in high-tech creative fields.

To counter this, the literature recommended multiple strategies: gender-sensitive critique models, mentorship programs with diverse faculty and alumni, collaborative peer learning, and inclusive design challenges that value a range of creative expressions. Chen emphasized that when female students are placed in mentorship or leadership roles within team projects, their CSE scores improve significantly, suggesting that experiential affirmation can help close the confidence gap [26].

The key takeaway is that the conversion of LA to CSE is not gender-neutral and may require differentiated support. Educators must be alert to classroom dynamics that inhibit certain students from fully expressing their creative potential, and must implement strategies that foster equitable engagement and validation.

4.4 Digital and AI Tools as Catalysts for Creative Development

One of the most promising areas of growth in recent design education research is the role of AI and digital tools in facilitating both IT and CSE. When used thoughtfully, digital platforms can democratize access to sophisticated design processes, accelerate ideation, and provide immediate visual feedback—all of which enhance students' motivation and confidence. Tools like Figma, DALL-E, Adobe Firefly, and Runway ML allow students to generate prototypes, explore stylistic alternatives, and visualize complex ideas without the barrier of advanced technical training.

This review showed that students using AI-assisted tools frequently exhibited higher creative confidence, especially in early-stage ideation. For example, [9] reported that students using AI-generated visual prompts were more likely to explore unconventional ideas and iterate more deeply on their designs. This aligns with the idea that reducing the "cost" of experimentation (time, skill, effort) increases creative risk-taking and iteration cycles.

However, the literature also highlighted potential downsides. Over-reliance on AI outputs may lead to a reduction in manual dexterity, loss of originality, or passive consumption of algorithmically suggested visuals. In study by [30], students who depended heavily on AI-generated imagery were less confident when asked to

generate ideas without digital assistance. This suggests that while AI can scaffold early creative development, we should complement it with activities that cultivate internal ideation and reflection.

While AI tools support creativity, ethical concerns arise around authorship, originality, and algorithmic bias. Future studies should explore: (1) How should student authorship be credited when using generative AI? (2) What biases are embedded in AI training datasets, and how do they influence creative expression? From a pedagogical perspective, the goal should be to treat AI as a collaborator rather than a replacement in the creative process. Courses should teach students not only how to use AI but also how to critique, refine, and humanize AI outputs. Doing so enables students to develop a symbiotic relationship with technology that enhances rather than diminishes CSE [31].

4.5 Cultural Contexts and the Case of Xi'an

This review also underscores the importance of cultural context in shaping how LA, IT, and CSE manifest in educational settings. Several studies based in Xi'an—a historical and cultural hub in China—illustrated how students integrated traditional design motifs, such as calligraphy and ink painting, with contemporary software tools and global aesthetic trends. This synthesis was not only culturally meaningful but also pedagogically powerful, as students reported stronger motivation and pride in their creative outputs when rooted in local identity [34].

Cultural hybridity, when encouraged in the curriculum, appeared to fuel both IT and CSE by enabling students to draw from multiple knowledge systems and reinterpret them through a global lens. Moreover, in collectivist societies like China, collaborative assignments and group critiques reinforced LA and creative belief systems. However, the review also cautioned that creativity assessments in cross-cultural contexts should account for these variations in expression, avoiding Western-centric criteria that may undervalue culturally grounded innovation. Few studies investigate how cultural identity, language, and socioeconomic status intersect with gender in shaping creative confidence. Research should adopt an intersectional lens to illuminate barriers and strengths in marginalized learner populations.

Thus, educators working in diverse global contexts must balance global design trends with local cultural narratives, using culturally responsive pedagogy to support creative development that is both authentic and innovative.

4.6 Limitations and Directions for Future Research

While this review establishes the interrelated roles of LA, Innovative Thinking (IT), and CSE in design education, it also reveals several notable gaps in the current body of research that warrant deeper and more targeted empirical exploration. These limitations point to specific areas where methodological innovation and expanded scope are necessary to strengthen the field's theoretical and practical contributions.

A major limitation lies in the predominant reliance on cross-sectional research designs. Most studies examined provide only a static snapshot of students' motivational and cognitive profiles, limiting insight into how these

characteristics develop or change over time. Such short-term designs fail to account for the evolving nature of self-efficacy, particularly in response to sustained educational interventions like iterative critique, experiential learning, or the integration of digital tools. Longitudinal cohort studies, which follow students throughout the duration of their academic programs, would offer a richer understanding of how LA, IT, and CSE interact across different learning stages. For instance, tracking students from entry-level courses through capstone design projects could illuminate whether pedagogical strategies have lasting effects on creative development. Prior studies suggest the promise of such approaches, yet few have implemented them systematically.

The literature exhibits inconsistency in measuring CSE, in addition to temporal limitations. While some researchers utilize validated instruments such as Karwowski's CSE Scale, others rely on custom Likert-style surveys that lack rigorous validation. This variability compromises the comparability of findings and hinders meta-analytical synthesis. To address this, future research should adopt more rigorous methodologies such as randomized controlled trials (RCTs) that combine self-report measures with artifact-based assessments. Evaluating students' actual creative outputs—such as design portfolios or project critiques—alongside perceived confidence would allow for more accurate assessments of learning outcomes.

Another critical gap involves the underexplored intersections of identity within the study of CSE. While gender disparities are increasingly acknowledged—with female students often reporting lower CSE despite strong performance in innovative tasks—few studies extend this analysis to consider how race, socioeconomic status, language background, or other identity factors interact with gender to shape learning experiences. Addressing this complexity requires intersectional mixed-method designs that incorporate both quantitative and qualitative insights. Surveys can capture broad trends, while interviews and focus groups can reveal how cultural and social dynamics impact students' sense of agency and belonging in design classrooms. Research by Chen and Taylor and his colleagues points to the efficacy of inclusive mentorship and critique models, but deeper exploration is needed to understand how different forms of marginalization compound to influence CSE.

Finally, although AI is an emerging force in design education, ethical considerations surrounding its use remain insufficiently explored. While some studies focus on how AI enhances ideation or accelerates iteration, few critically examine the challenges of authorship, originality, and algorithmic bias. As AI-generated visuals become more common in student work, there is an urgent need to establish clear ethical guidelines that balance technological innovation with academic integrity. The Delphi method—a structured approach for building expert consensus—offers a valuable framework for this endeavor. Engaging educators, technologists, and ethicists in structured dialogue can help articulate shared principles for AI integration in design curricula.

Together, these four research directions—longitudinal tracking, consistent and multimodal assessment of CSE, intersectional inquiry, and ethical governance of AI—represent essential priorities for advancing the study of creativity in design education. Addressing them will not only fill theoretical gaps but also inform more equitable, innovative, and reflective pedagogical practices.

5. Conclusion

This systematic review set out to examine the relationship between LA and CSE in graphic design education, with particular attention to the mediating role of IT, gender-based variations, and the growing influence of digital and AI tools. Synthesizing findings from 50 empirical studies published between 2010 and 2025, the review confirms that these three constructs—LA, IT, and CSE—are not only individually significant but deeply interconnected in shaping creative outcomes in design learners.

A core conclusion is that LA acts as a motivational foundation that propels students toward engaging more actively in creative problem-solving and design exploration. However, the development of innovative thinking skills channels this motivational drive most effectively. IT serves as the cognitive engine that translates interest and effort into originality, adaptability, and design confidence. When students are trained to observe critically, question conventions, synthesize diverse ideas, and prototype iteratively, they develop a stronger belief in their ability to solve visual communication challenges in novel ways. In turn, this growing CSE becomes self-reinforcing, encouraging further creative engagement and risk-taking.

The review also highlights persistent gender disparities in CSE. Although male and female students often demonstrate comparable LA and cognitive strategies, female students frequently report lower confidence in their creative abilities, particularly in technology-intensive design tasks. Classroom dynamics, cultural perceptions, and unequal exposure to affirming experiences, rather than capacity, root these disparities. Addressing these discrepancies requires intentional pedagogical design, including inclusive critique practices, mentorship programs, and increased visibility of diverse creative role models.

Technological tools—especially AI-driven platforms—are transforming the creative learning landscape. While AI can accelerate ideation and enhance student engagement, educators must remain vigilant about the potential over-reliance on automation and the risk of diminishing critical, original thinking. The most effective educational models position AI as a catalyst for innovation rather than a substitute for it.

Ultimately, this review affirms that creativity in design education is not merely a product of talent but the result of interdependent motivational, cognitive, and contextual factors. By cultivating intrinsic motivation, embedding innovative thinking into curricula, and supporting equitable access to tools and experiences, educators can build environments in which all students—regardless of gender or background—are empowered to express their creative potential confidently and authentically.

Acknowledgements

This research was supported by the 2024 Shaanxi Provincial Art Science Planning Project (Project No. SYF2024002), titled *"Research on the Evolution of Children's Book Illustration Design since the Founding of the People's Republic of China."*

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