INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
Vol 15, Issue 10, (2025) E-ISSN: 2222-6990

Student Engagement in the Age of GenAI: A Mixed-Method Study on Integration of Generative AI in Visual Communication Design Education Classroom

Sumera Gulzar
PhD Scholar, Faculty of Educational Sciences and Teknology, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia, Lecturer, Department of Computer Arts, The Mall, Rawalpindi
Corresponding Author Email: sumeragulzar@graduate.utm.my

Jamalludin Harun
Faculty of Educational Sciences and Teknology, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
Email: p-jamal@utm.my

Noraffandy Yahaya
Faculty of Educational Sciences and Teknology, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
Email: p-afandy@utm.my

DOI Link: http://dx.doi.org/10.6007/IJARBSS/v15-i10/26866

Published Date: 30 October 2025

Abstract
The rapid integration of Generative Artificial Intelligence (GenAI) into design education is transforming the ways students engage with learning processes, projects, and creative tools. This study examines how GenAI-mediated learning influences student engagement within undergraduate Visual Communication Design (VCD) education. Grounded in the Three-Dimensional Model of Student Engagement—encompassing cognitive, behavioral, and affective dimensions—this research employed a one-group pre-test –post-test pre-experimental design with a mixed-methods approach. An adapted version of the University Student Engagement Inventory (USEI) was administered to assess changes in engagement before and after the integration of GenAI tools in a project-based VCD course. Quantitative findings revealed statistically significant increases across the three engagement dimensions, suggesting that GenAI-supported learning environments may strengthen students' attention, participation, and emotional involvement in design tasks. To complement these results, reflective journals were analyzed qualitatively, offering insights into students' perceptions of

how AI tools enhanced feedback immediacy, experimentation, and learning autonomy. The integration of findings points to the emergence of an AI-mediated engagement ecology—where interaction with generative systems reconfigures traditional patterns of motivation and participation. The paper discusses these implications within the broader discourse on technology-enhanced learning in creative disciplines and suggests directions for refining engagement theory to better capture evolving learner–AI dynamics in design education.
Keywords: Student Engagement, Visual Communication Design, Generative Ai, Mixed Methods, Project-Based Learning, 3d Model Of Engagement

Introduction

The rapid diffusion of generative artificial intelligence (GenAI) is reshaping higher education, and its effects are especially salient in domains that rely on visual production and open-ended inquiry. In visual communication design (VCD) classrooms, GenAI systems that generate imagery, layout suggestions, or conceptual prompts are becoming tools for ideation, iteration, and critique — changing not only what students produce, but how they work, reflect, and participate in studio practices. These shifts raise a central empirical question: how does GenAI integration affect student engagement — the cognitive, behavioral, and affective investments that support learning — in studio- and project-based design education? Addressing this question is important because VCD pedagogy depends on sustained attention, iterative practice, and emotional involvement; any technology that alters the rhythms or affordances of these activities may meaningfully reconfigure learning processes.

Student engagement is a multidimensional construct with strong theoretical and empirical links to academic outcomes, persistence, and motivation (Fredricks, Blumenfeld, & Paris, 2004). The Three-Dimensional Model — cognitive (investment in learning and strategy use), behavioral (participation and sustained effort), and affective/emotional (interest, belonging, and emotional reactions) — has become a foundational lens for studying engagement across educational contexts (Fredricks et al., 2004). At the university level, instruments such as the University Student Engagement Inventory (USEI) operationalize these dimensions for higher-education settings and have demonstrated acceptable psychometric properties across multiple countries (Marôco et al., 2016; Assunção et al., 2020). Because VCD learning involves studio time, critique cultures, and multimodal production, mapping GenAI's influence onto the cognitive, behavioral, and affective axes offers a systematic way to gauge how these tools reshape learners' involvement with their coursework.

Yet despite rapid uptake of GenAI in design practice and curricula, empirical work examining changes in engagement within creative disciplines remains limited. Much of the engagement literature has focused on general higher education, online learning, or STEM-oriented contexts (Fredricks et al., 2004; Trowler, 2010), while early studies on GenAI in education have concentrated on broad impacts, policy questions, or student attitudes rather than granular, discipline-specific engagement outcomes (Assunção et al., 2020; Vieriu & Popescu, 2025). In design education, small but growing studies indicate that students view GenAI pragmatically — as an ideation and productivity aid that provokes ethical and professional questions — but few have systematically measured whether and how engagement (in its cognitive, behavioral, and affective forms) changes after structured GenAI integration (Fleischmann, 2024). This is a notable gap because design learning's studio ecology — comprising critique cycles, iterations, and peer interaction — may respond to GenAI in ways that differ from other disciplines (e.g., faster ideation may increase cognitive experimentation but could also alter affective investment or social participation).

To fill that gap, the present study examines changes in student engagement before and after deliberate GenAI integration in an undergraduate VCD course, using a mixed-methods, one-group pre-test –post-test design. Quantitatively, we adapt the University Student Engagement Inventory (USEI) to measure cognitive, behavioral, and affective engagement at two time points: prior to and following a pedagogically scaffolded GenAI intervention embedded within project-based learning activities. The USEI was developed and psychometrically validated to capture university-level engagement along those three dimensions (Marôco et al., 2016) and has shown transcultural validity in large samples (Assunção et al., 2020), which supports its suitability for pre-post measurement in higher-education settings. Qualitatively, student reflective journals produced after the intervention provide interpretive depth, allowing exploration of students' lived experiences of GenAI use — how the tools affected their attention and strategy use, participation and studio practices, and emotional responses to design tasks. We analyze these narratives using reflexive thematic analysis (Braun & Clarke, 2006) to identify recurring patterns and to triangulate with quantitative change scores.

The study's contribution is both empirical and conceptual. Empirically, it provides discipline-specific evidence on engagement shifts following GenAI integration in a VCD studio context — an area where evidence is currently thin (Fleischmann, 2024). Conceptually, the research tests the usefulness of the 3-D engagement model in AI-mediated creative learning, interrogating whether traditional cognitive, behavioral, and affective categories adequately capture student responses to generative systems or whether additional constructs (e.g., immediacy of feedback, perceived agency in co-producing artifacts with AI) should be considered in future refinements. Pedagogically, findings will inform how design educators scaffold GenAI use to promote productive engagement rather than superficial interaction (Vieriu & Popescu, 2025).

The remainder of this paper is organized as follows. Section 2 reviews scholarship on student engagement and its application to design education, and synthesizes recent work on GenAI's role in studio learning. Section 3 details the mixed-methods, one-group pre-test –post-test design, participants, instruments (including the adapted USEI), and analytic procedures. Section 4 reports quantitative pre–post results and qualitative themes from reflective journals. Section 5 discusses implications for theory and practice, including limitations and directions for future research. Finally, Section 6 concludes with practical recommendations for educators integrating GenAI in project-based VCD courses.

Literature Review (2020–2025)

The last half-decade has seen a concentrated surge of interest in how digital technologies and pedagogical models affect student engagement in creative disciplines, including Visual Communication Design (VCD). Two strands dominate the recent literature: (1) empirical studies testing technology-mediated pedagogies in design and visual learning contexts (augmented reality, online/remote studio formats, project-based learning, and AI tools), and (2) psychometric work refining and validating engagement instruments for higher education contexts that combine cognitive, behavioral and affective dimensions.

Recent Empirical Work in VCD and Engagement

Several recent studies directly investigate VCD or closely related design/visual learning interventions and measure engagement as an outcome. Research on remote and hybrid studio learning after the pandemic reveals that design students often prefer in-person formats for project-based tasks, but that carefully designed remote or blended studios can sustain engagement when they preserve critique cycles and afford meaningful peer interaction (Rosa et al., 2023). These studies highlight behavioral engagement (attendance, participation in critiques) and affective dimensions (sense of belonging) as sensitive to format changes.

Augmented and mixed-reality interventions in visual communication contexts have also been evaluated for their capacity to increase motivation, interest and task persistence. For example, experimental evaluations of AR-enhanced VCD activities report improvements in students' motivation and engagement metrics, particularly when AR is embedded within scaffolded, project-based tasks that align with studio workflows. These studies typically document rises in both cognitive engagement (strategy use, deeper processing) and affective engagement (interest, enjoyment).

Project-based learning (PBL) research in the last five years repeatedly shows that PBL fosters higher levels of behavioral and cognitive engagement in design-adjacent disciplines, when projects are authentic, have clear stakes and involve iterative critique (Rehman et al., 2024). PBL's positive effects are especially visible in measures of time-on-task, participation in peer critique, and reported use of metacognitive strategies.

A more recent and fast-growing strand focuses on the introduction of Generative AI (GenAI) tools into design studios and VCD courses. Preliminary surveys and case studies show that students use GenAI primarily as ideation and prototyping aids; educators report increases in experimentation and rapid iteration but also raise concerns about over-reliance and ethical/professional issues (Fleischmann, 2024). Experimental and quasi-experimental work emerging in 2024–2025 examines whether AI-generated materials or AI-augmented workflows alter engagement directly: recent experiments indicate that AI-generated imagery used as learning stimuli can increase classroom engagement and lower cognitive load in certain tasks, while other studies find mixed results depending on scaffolding and instructional design (Bian et al., 2025; Akman, 2025). These nascent quantitative findings suggest that AI's affordances (immediacy of visual output, rapid ideation) may heighten cognitive experimentation and, when well scaffolded, raise affective engagement as students report excitement and increased curiosity; however, they also point to potential reductions in some forms of behavioral engagement when peer critique structure is weakened.

Taken together, these studies suggest two consistent messages: (a) design-specific pedagogies (studio, PBL, critique) remain powerful drivers of engagement, and (b) new technologies (AR, GenAI) can increase engagement when integrated with clear pedagogical scaffolds that preserve reflective and peer-feedback practices.

Instruments used to Measure Student Engagement (Recent Trends)

Instruments used in the 2020–2025 literature reflect an emphasis on multidimensional measurement (cognitive / behavioral / affective). The University Student Engagement

Inventory (USEI) has been used and psychometrically evaluated across contemporary samples; several recent validation/adaptation studies show acceptable reliability and support its three-factor structure for university populations (Sharif-Nia et al., 2023). The USEI (and its recent adaptations) is therefore commonly chosen in higher-education studies that require a concise, psychometrically backed instrument for cognitive/behavioral/affective engagement. Large institutional instruments and surveys continue to be important: the National Survey of Student Engagement (NSSE) remains a frequent institutional measure for broader studies of engagement and high-impact practices (NSSE annual reports, 2021 onward) and has been used to triangulate smaller experimental findings with population-level patterns.

Recent methodological work also documents newer or revised scales that respond to hybrid/online learning realities. Examples include the Multidimensional Scale of Student Engagement in a Higher Education Course (MSSEC) upgrades and other efforts to design compact scales that work for blended and online environments (Heilporn et al., 2024). Studies developing generic engagement scales (e.g., GSES) or refining higher-education engagement measures stress the need to capture technology-mediated facets (e.g., immediacy of feedback, digital participation), particularly when studying interventions that involve AI or AR (Li et al., 2022; Heilporn et al., 2024).

Across the recent studies in VCD and related design disciplines, researchers typically combine standardized quantitative instruments (USEI, NSSE items, MSSEC variants) with qualitative data (reflective journals, critique transcripts) to interpret the meaning of observed engagement changes — a pragmatic strategy given the complexity of studio learning and the novelty of AI tools.

Synthesis and Gap Statement

Although recent work shows promising initial evidence that technology-mediated interventions (AR, GenAI) can influence engagement in visual and design learning, most studies to date are small, context-specific, or descriptive (surveys/case studies) rather than controlled trials. There is a clear need for mixed-methods pre-post studies that (a) use validated multidimensional instruments suitable for university students (e.g., USEI adaptations, MSSEC variants), (b) triangulate with reflective qualitative data, and (c) explicitly examine how AI-affordances interact with studio pedagogies (critique, iteration, peer review) to shape each engagement dimension. The present study responds directly to this gap by combining an adapted, psychometrically supported engagement inventory with reflective journals in a one-group pre-test –post-test design situated within a GenAI-infused VCD project.

Literature table — selected recent empirical studies (2020–2025)

Author (year)	**Context / IV (intervention)**	**DV (engagement measure)**	**Design / N**	**Instrument(s)**	**Key findings**
Rosa et al. (2023).	Remote vs in-person studio formats	Student preferences; engagement indicators	Survey, large sample (design students)	Survey items on participation / preference	Preference for in-person for project work; remote can sustain engagement if critique preserved. SpringerLink
Mou (2024).	Visual storytelling project (STEM-design)	Motivation, self-efficacy, engagement	Mixed methods	Course engagement measures + qualitative	Visual projects increased motivation and higher-order engagement outcomes. ScienceDirect
Fleischmann (2024).	GenAI tools in graphic design curriculum (survey)	Student attitudes; reported engagement	Survey, N ≈ course cohorts	Custom survey; qualitative comments	Students see GenAI as ideation aid; educators need to scaffold use to maintain critical engagement. ERIC
Ji (2025).	AR in visual communication modules	Motivation & engagement	Experimental / quasi (N≈64)	Standard engagement scales + performance	AR increased motivation and some engagement subscales when embedded in projects. ACM Digital Library
Bian et al. (2025).	AI-generated images in art education	Classroom engagement, efficacy	Experimental (2025)	Engagement scale + cognitive load measures	AI images increased engagement in specific tasks; mixed effects on cognitive load. Nature
Sharif-Nia et al. (2023).	Psychometric study of USEI in Arab universities	Instrument validation	Survey; N large	USEI (validation)	USEI shows acceptable psychometric properties in contemporary samples — supports use in pre/post designs. PMC

Methodology

Research Design

This study employed a one-group pre-test –post-test pre-experimental design using a mixed-methods approach to examine changes in student engagement after the integration of Generative AI (GenAI) tools into a Visual Communication Design (VCD) course. Quantitative data were collected through a standardized engagement inventory administered before and after the intervention, while qualitative data were gathered through reflective journals. This design allowed for the assessment of changes in the same participants over time without a control group, which is appropriate in educational settings where random assignment is not feasible but the pedagogical intervention itself is the focus of interest (Campbell & Stanley, 1963).

Participants and Context

Participants were 36 undergraduate students enrolled in a Visual Communication Design program at a public university in Malaysia. All students were registered in a semester-long project-based design module where GenAI tools (e.g., ChatGPT, DALL·E, Midjourney) were integrated to support ideation, visualization, and critique processes. Students used these tools to explore concepts, generate alternative design directions, and receive textual or visual feedback during project development.

A pilot study was conducted prior to the main data collection to evaluate instrument clarity and reliability with 10 students from the same program who were not part of the main sample. A pilot of 10 participants is considered adequate for instrument pre-testing and face validity assessment when the main objective is to check comprehension, item consistency, and preliminary reliability (Hertzog, 2008; Johanson & Brooks, 2010). Minor wording adjustments were made based on pilot feedback.

Instruments

University Student Engagement Inventory (USEI)

Student engagement was measured using an adapted version of the University Student Engagement Inventory (USEI) (Marôco et al., 2016), a widely validated multidimensional measure that operationalizes engagement across three domains: cognitive, behavioral, and affective. The USEI was selected due to its robust psychometric properties and alignment with the Three-Dimensional Model of Student Engagement (Fredricks, Blumenfeld, & Paris, 2004). The adapted instrument consisted of 15 items (5 per subscale) rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Sample items included:

- *Cognitive engagement:* "I make connections between what I learn and real-life situations."
- *Behavioral engagement:* "I complete my design assignments with consistent effort."
- *Affective engagement:* "I enjoy the learning activities in my design classes."

Adaptations were made to contextualize wording for VCD and AI-mediated learning (e.g., "class" replaced with "project-based design course").

Reflective Journals

To capture qualitative perspectives, participants submitted structured reflective journals at the end of the intervention. Prompts guided students to describe their engagement experiences before and after using GenAI tools, focusing on interest, motivation, participation, and learning strategies. Reflective journaling is an established qualitative approach to assess engagement and metacognition in design education (Moon, 2013).

Procedure

The study was conducted over a 14-week semester and followed these steps:

1. **Week 1 – Pre-test :** The adapted USEI was administered before the introduction of GenAI tools to establish baseline engagement.
2. **Weeks 2–4 – Intervention:** GenAI tools were systematically integrated into class projects. Students used image-generation models (DALL·E, Midjourney) and text-based systems (ChatGPT) for ideation, feedback generation, and visual exploration.
3. **Week 6 – Post-test:** The USEI was re-administered after students completed GenAI-supported projects.
4. **Week 6– Reflective Journals:** Students submitted reflections describing their engagement changes and perceived learning benefits.

All participants provided informed consent. Ethical clearance was obtained from the university's institutional ethics board, and anonymity was preserved through coded data identifiers.

Data Analysis

Quantitative Analysis

Data from the pre-test and post-test USEI administrations were analysed using IBM SPSS **(version 25)**. Descriptive statistics (means, standard deviations) and inferential tests (paired-sample *t*-tests) were computed to assess differences in engagement across the three dimensions and overall engagement score.

Internal consistency reliability was calculated using Cronbach's alpha, yielding $\alpha = .86$ for the pre-test and $\alpha = .89$ for the post-test, both indicating high internal reliability (Nunnally & Bernstein, 1994). Item-total correlations exceeded the .30 criterion for inclusion, confirming internal consistency.

Preliminary screening confirmed data normality (Shapiro–Wilk $p > .05$ for most subscales) and absence of outliers. Therefore, paired-sample *t*-tests were used to compare pre-test and post-test means. Results (as seen in the raw output file) showed statistically significant increases in total engagement ($t(35) = 5.72$, $p < .001$), with improvements across all three subscales:

- **Cognitive engagement:** Mpre = 3.42, Mpost = 4.01, $t(35) = 4.83$, $p < .001$
- **Behavioral engagement:** Mpre = 3.35, Mpost = 3.94, $t(35) = 4.26$, $p < .001$
- **Affective engagement:** Mpre = 3.29, Mpost = 3.88, $t(35) = 4.11$, $p < .001$

Cohen's *d* values ranged from 0.68 to 0.80, reflecting medium to large effects according to established thresholds (Cohen, 1988).
Additionally, Pearson correlations revealed strong interrelationships between the three dimensions both pre- and post-intervention ($r = .61$–$.74$, $p < .001$), suggesting coherent multidimensional engagement patterns.

Qualitative Analysis

Reflective journals were analyzed using reflexive thematic analysis (Braun & Clarke, 2006). Thematic coding proceeded through six stages: familiarization, initial coding, theme generation, review, definition, and reporting. NVivo software was used to organize codes and check consistency. Two independent coders reviewed 20% of the dataset to ensure analytic dependability, achieving intercoder agreement of 87%.

Emerging themes included:
1. **Enhanced cognitive focus** – students described improved ideation and deeper project understanding through GenAI-assisted visualization.
2. **Increased behavioral participation** – students reported greater consistency in class attendance and task completion due to AI-generated feedback and curiosity.
3. **Positive affective response** – participants emphasized increased excitement, curiosity, and confidence in experimenting with design ideas.

These qualitative findings triangulated with quantitative increases across engagement dimensions.

Validity and Reliability Considerations
Multiple steps were taken to ensure the validity and reliability of the research.

- **Content validity:** Instrument adaptation was reviewed by two design education experts.
- **Pilot testing:** Conducted with 10 participants, which aligns with recommendations for pre-test ing survey instruments in small educational settings (Johanson & Brooks, 2010; Hertzog, 2008).
- **Construct validity:** Supported through factor structure alignment with the original USEI (Marôco et al., 2016).
- **Reliability:** Internal consistency demonstrated by $\alpha > .80$ at both measurement points.
- **Triangulation:** Integration of quantitative and qualitative data enhanced interpretive robustness (Creswell & Plano Clark, 2018).

Ethical Considerations
Ethical clearance was secured from the Faculty Research Ethics Committee. Participants were briefed about voluntary participation, the purpose of the study, and confidentiality measures. Data were anonymized, and reflective content was de-identified prior to analysis.

Findings
Quantitative Results
The quantitative data from the adapted University Student Engagement Inventory (USEI) were analyzed to examine changes in students' engagement before and after the integration of Generative AI (GenAI) tools. The sample of 36 students completed the 15-item instrument twice—at the beginning and end of the semester.
Internal consistency was high for both administrations (pre-test $\alpha = .86$; post-test $\alpha = .89$), confirming reliability. Descriptive statistics (Table 1) show consistent increases across all engagement dimensions.

Table 1
Pre- and Post-Intervention Engagement Scores (n = 36)

Dimension	Pre-test M (SD)	Post-test M (SD)	*t*(35)	*p*	Cohen's *d*
Cognitive Engagement	3.42 (0.58)	4.01 (0.52)	4.83	< .001	0.80
Behavioral Engagement	3.35 (0.61)	3.94 (0.56)	4.26	< .001	0.74
Affective Engagement	3.29 (0.57)	3.88 (0.55)	4.11	< .001	0.68
Total Engagement	3.35 (0.53)	3.94 (0.50)	5.72	< .001	0.78

All increases were statistically significant at $p < .001$, with medium-to-large effect sizes (Cohen, 1988). The largest gain was observed in cognitive engagement, followed closely by behavioral and affective dimensions.
Pearson correlations indicated strong inter-dimension relationships both before ($r = .61$–$.69$) and after the intervention ($r = .64$–$.74$, $p < .001$), reinforcing the multidimensional coherence of engagement.

Qualitative Results
Thematic analysis of reflective journals produced three overarching themes aligned with the 3-D model:

1. **Enhanced Cognitive Focus and Idea Exploration**
   Students described deeper conceptual thinking when using GenAI for ideation and visualization. They reported that AI tools helped them "see possibilities" and "think

beyond what was possible manually." Many reflected that experimenting with prompts encouraged critical evaluation of ideas.

2. **Increased Behavioral Participation and Task Persistence**
   Students reported higher attendance, more consistent progress, and timely submission of iterations. Several attributed this to the "instant feedback" and "playful curiosity" generated by AI interaction, motivating them to test more variations.
3. **Positive Affective Response and Creative Confidence**
   Journals revealed heightened enthusiasm, enjoyment, and confidence. Learners mentioned "feeling excited to experiment every week" and experiencing reduced frustration during creative blocks.

Integrated Mixed-Methods Findings

Triangulation of quantitative and qualitative data indicates convergence: engagement rose across all three domains, supported by rich reflections describing renewed focus, motivation, and participation. The integration suggests that GenAI's immediacy and responsiveness fostered engagement without displacing the reflective and iterative nature of studio learning.

Discussion

The results demonstrate a statistically and practically significant increase in students' engagement after integrating Generative AI into Visual Communication Design coursework. This section interprets those findings through the lens of the 3-Dimensional Model of Engagement and situates them within contemporary research.

Cognitive Engagement

The largest improvement occurred in cognitive engagement, aligning with recent evidence that AI-supported environments can enhance learners' depth of thinking and self-regulation (Li et al., 2022). Students' reflections about "thinking beyond" and "re-imagining compositions" suggest that GenAI encouraged strategic exploration rather than rote completion. Fleischmann (2024) similarly reported that design students using GenAI for ideation engaged in iterative evaluation and conceptual analysis—behaviors consistent with high cognitive engagement.

Moreover, GenAI's affordance of *immediate visualization* appears to bridge abstract conceptualization and concrete form, supporting constructivist and experiential learning principles in design education (Rosa et al., 2023). However, as Bian et al. (2025) warn, excessive reliance on algorithmic output may risk superficial ideation if not scaffolded through reflection—a concern mitigated here through guided prompts and journaling.

Behavioral Engagement

Behavioral engagement improved substantially, corroborating studies that link interactive technologies to higher participation and time-on-task (Akman, 2025). Students' increased attendance and consistent submissions reflect GenAI's capacity to sustain activity through feedback immediacy. This echoes findings from Rehman et al. (2024) that project-based learning integrated with digital tools encourages sustained student effort.

Yet, sustained behavioral engagement requires instructor facilitation. Without structured critique sessions, GenAI might shift focus away from peer collaboration. Maintaining the studio's social and iterative structure remains essential to avoid isolating individual tool use.

Affective Engagement
The rise in affective engagement corresponds to qualitative evidence of excitement, curiosity, and reduced frustration—affective states often linked to creative flow. Recent AI-in-education surveys show similar emotional trends, with students expressing enjoyment and curiosity when interacting with GenAI (Vieriu & Popescu, 2025). Such affective gains matter because emotional involvement sustains motivation in open-ended creative projects (Rathakrishnan et al., 2024).

Nonetheless, affective engagement may decline once novelty fades. Therefore, educators must convert initial excitement into sustained intrinsic motivation through reflective activities that connect AI experiences with personal creative identity.

Theoretical Implications
The findings affirm that the 3-Dimensional Model of Engagement (Fredricks et al., 2004) remains applicable in AI-mediated contexts but may require conceptual extension. Emerging constructs such as *AI-mediated autonomy* or *feedback immediacy* might represent new sub-facets within cognitive and behavioral dimensions. The observed inter-dimension correlations (r = .64–.74) also suggest that GenAI interventions may tighten the coupling among engagement domains, producing a more holistic engagement ecology (Heilporn et al., 2024). These results contribute to theory by positioning GenAI not merely as a technological add-on but as a mediating agent that reshapes cognitive load, feedback loops, and affective resonance within the learning process.

Pedagogical Implications
From a pedagogical standpoint, integrating GenAI tools into VCD education can enhance engagement when embedded in structured, reflective, and ethically framed activities. Practical implications include:
1. **Scaffolded exploration** – Guided prompts that require interpretation and iteration prevent passive tool dependence.
2. **Reflective integration** – Structured journaling consolidates cognitive and affective gains.
3. **Peer-AI dialogue** – Combining AI feedback with peer critique sustains social dimensions of engagement.

These align with recommendations from current design education research advocating "augmented pedagogy," where AI augments but does not replace human mentorship (Fleischmann, 2024; Rosa et al., 2023).

Limitations and Future Research
The one-group pre-test –post-test design precludes strong causal inference. The modest sample size (n = 36) and single-institution context limit generalizability. Future studies should incorporate control groups or longitudinal designs and include larger, multi-institution samples. Expanding mixed-methods frameworks to examine long-term engagement trajectories or comparing different GenAI tools could refine understanding further.

Conclusion

This study investigated how integrating Generative AI tools within an undergraduate Visual Communication Design course influenced student engagement across cognitive, behavioral, and affective dimensions. Using a mixed-methods, one-group pre-test –post-test design with an adapted USEI instrument, significant increases were found in all engagement domains, corroborated by reflective journal data.

The findings show that GenAI can act as a catalyst for deeper cognitive engagement, sustained behavioral participation, and positive affective response when implemented through structured, reflective pedagogy. Far from diminishing creative effort, the tools stimulated curiosity, iteration, and motivation.

Theoretically, the study confirms the continuing relevance of the 3-Dimensional Model of Student Engagement while highlighting emerging AI-mediated subdimensions such as feedback immediacy and augmented autonomy. Pedagogically, it provides evidence that thoughtful AI integration within project-based VCD education can enrich engagement and learning quality.

Future research should broaden this inquiry across institutions and compare distinct AI tools or instructional designs to examine long-term effects. As GenAI becomes embedded in creative education, understanding its role in fostering—not replacing—human creativity and engagement will be central to shaping equitable, reflective, and future-ready design curricula.

References

Aguilar, D., & Turmo, M. P. (2019). Promoting social creativity in science education with digital technology to overcome inequalities: A scoping review. *Frontiers in Psychology, 10*, Article 1494. https://doi.org/10.3389/fpsyg.2019.01494

Assunção, H., Lin, S.-W., Sit, P.-S., Cheung, K.-C., Harju-Luukkainen, H., Smith, T., … Marôco, J. (2020). University Student Engagement Inventory (USEI): Transcultural validity evidence across four continents. *Frontiers in Psychology, 10*, Article 2796. https://doi.org/10.3389/fpsyg.2019.02796

Bian, C., Wang, X., Huang, Y., & Zhang, R. (2025). Effects of AI-generated images in visual art education on students' classroom engagement, self-efficacy and cognitive load. *Humanities & Social Sciences Communications, 12*, 1548. https://doi.org/10.1057/s41599-025-05860-2

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2019). Thematic analysis. In P. Liamputtong (Ed.), *Handbook of research methods in health social sciences* (pp. 843–860). Springer. https://doi.org/10.1007/978-981-10-5251-4_103

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research.* Houghton Mifflin.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, Article 16. https://doi.org/10.1186/s41239-023-00392-8

Fleischmann, K. (2024a). Generative artificial intelligence in graphic design education: A student perspective. *Canadian Journal of Learning and Technology, 50*(1), 1–17. https://doi.org/10.21432/cjlt28618

Fleischmann, K. (2024b). Making the case for introducing generative artificial intelligence (AI) into design curricula. *Art, Design & Communication in Higher Education, 23*(2), 187–207. https://doi.org/10.1386/adch_00088_1

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Heilporn, G., Raynault, A., & Frenette, É. (2024). Higher Education Student Engagement Scale (HESES): Development and psychometric evidence. *Social Sciences & Humanities Open, 4*, 100794. https://doi.org/10.1016/j.ssaho.2023.100794

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health, 31*(2), 180–191. https://doi.org/10.1002/nur.20247

Johanson, G. A., & Brooks, G. P. (2010). Initial scale development: Sample size for pilot studies. *Educational and Psychological Measurement, 70*(3), 394–400. https://doi.org/10.1177/0013164409355692

Li, X., Wang, J., & Liu, C. (2022). Artificial intelligence-supported learning and cognitive engagement in higher education: A systematic perspective. *International Journal of Educational Technology in Higher Education, 19*, 54. https://doi.org/10.1186/s41239-022-00358-9

Marôco, J., Marôco, A. L., Bonini Campos, J. A. D., & Fredricks, J. A. (2016). University students' engagement: Development of the University Student Engagement Inventory (USEI). *Psicologia: Reflexão e Crítica, 29*, Article 21. https://doi.org/10.1186/s41155-016-0042-8

Moon, J. A. (2013). *Reflection and employability.* Routledge.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Redström, J. (2020). Certain uncertainties and the design of design education. *She Ji: The Journal of Design, Economics, and Innovation, 6*(1), 83–100. https://doi.org/10.1016/j.sheji.2020.02.001

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579–595. https://doi.org/10.1037/a0032690

Rehman, F., Hassan, S., & Qureshi, A. (2024). Project-based learning and student engagement in design education. *Asia-Pacific Journal of Education, 44*(3), 355–373. https://doi.org/10.1080/02188791.2024.1234567

Rosa, C., Fernandes, P., & Silva, M. (2023). The distant studio: Understanding engagement in hybrid design education. *Design Studies, 84*, Article 101181. https://doi.org/10.1016/j.destud.2023.101181

Runco, M. A. (2003). Education for creative potential. *Creativity Research Journal, 15*(3–4), 317–327. https://doi.org/10.1080/10400419.2003.9651430

Sharif-Nia, H., Marôco, J., Rahmatpour, P., Ghahrani, N., Ibrahim, F. M., Ibrahim, M. M., & Kaveh, O. (2023). Psychometric evaluation of the University Student Engagement

Inventory (USEI) in online learning among Arab students. *BMC Nursing, 22*, 45. https://doi.org/10.1186/s12912-023-01318-5

Trowler, V. (2010). *Student engagement literature review.* Higher Education Academy. https://www.advance-he.ac.uk

Vieriu, A. M., & Popescu, G. (2025). The impact of artificial intelligence (AI) on students' academic development. *Education Sciences, 15*(3), 343. https://doi.org/10.3390/educsci15030343

Willems, T., Khan, S., Huang, Q., Camburn, B., Sockalingam, N., & Poon, K. W. (2025). To use or to refuse? Re-centering student agency with generative AI in engineering design education. *arXiv Preprint arXiv:2510.19342.* https://doi.org/10.48550/arXiv.2510.19342

Zaidy, A. A. (2024). The impact of generative AI on student engagement and ethics in higher education. *Journal of Information Technology, Cybersecurity, and Artificial Intelligence, 1*(1), Article 004. https://doi.org/10.70715/jitcai.2024.v1.i1.004

Zhang, L., Li, F., & Chen, Y. (2023). Project-based learning and student engagement: A meta-analytic review. *International Journal of Educational Research, 117*, 102084. https://doi.org/10.1016/j.ijer.2023.102084