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Collaborative Learning Dynamics in Secondary School Visual Arts Projects Supported by Generative AI Tools.

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***Abstract*-- This study investigates how secondary school students in grades 10 to 12 in Peel and Toronto Region, Ontario, Canada, collaborate when using generative AI tools such as Adobe Firefly and Canva's Magic Media for visual arts projects, and how these collaborative patterns shape peer-to-peer creative knowledge transfer. Drawing on constructivist and sociocultural theories, the research explores emergent roles, interaction modes, and artifact-centered dialogue in AI-mediated group work. A mixed-methods design combined classroom observations, student surveys, and focus groups across selected schools in 2025, during a period of rapid but uneven adoption of AI in Ontario classrooms. Findings suggest that AI-supported visual arts projects can foster new collaborative learning patterns—such as "prompt co-design pairs," "iterative critique circles," and "AI–facilitated expert–novice mentoring"—which enhance the circulation of creative strategies, vocabulary, and design heuristics among peers. However, these benefits are moderated by access, teacher scaffolding, and students' baseline digital literacy, with some evidence of dependency on AI and marginalization of less confident students. The paper concludes by outlining design principles for an AI-driven collaborative learning ecosystem that centers equity, student agency, and responsible use in visual arts education in the Greater Toronto Area.**

***Keywords*-- generative AI; visual arts education; collaborative learning; creativity; peer-to-peer knowledge transfer; secondary students; AI Learning, AI Arts, AI Creativity**

I. INTRODUCTION

By 2025, generative AI had moved from the periphery of education into mainstream classroom practice in many Canadian schools, with students widely using AI tools for both academic and creative work. In Ontario, this shift has reached secondary visual arts classrooms, where tools such as Adobe Firefly and Canva's Magic Media enable rapid generation and refinement of complex images, even for students with limited traditional drawing skills.

School boards in the Greater Toronto Area, including the Peel District School Board and the Toronto District School Board, have been exploring how to leverage AI while responding to ethical, privacy, and academic integrity concerns.

At the same time, provincial and national guidance encourages educators to use AI as a scaffold for learning rather than a replacement for human creativity, emphasizing risk-aware, equity-centered implementation.

Existing research in art education suggests that generative AI can support creative thinking and participation by allowing students to experiment with styles and concepts through iterative prompt engineering and visual feedback. Studies of generative AI in secondary education also indicate that AI use can be associated with increased innovation capability and digital literacy when integrated with purposeful pedagogy. However, there is limited empirical work on how AI-mediated visual arts projects reshape collaborative learning patterns and peer-to-peer creative knowledge transfer in real school settings.

This study, led by me, Major Nagra, as part of my PhD thesis at Guru Kashi University, addresses this gap by focusing on grades 10–12 students in Peel and Toronto Region schools during the 2025 school year. It aligns with the broader theme of my research, "Enhancing Student Creativity through an AI-Driven Collaborative Learning Ecosystem," by exploring collaborative dynamics involving generative AI in the visual arts.

II. OBJECTIVES

The study pursues the following objectives:

1. To explore and describe the collaborative learning patterns that develop when secondary students (grades 10–12) use generative AI tools (e.g., Adobe Firefly, Canva's Magic Media) for visual arts projects in Peel and Toronto region schools in 2025.
2. To examine how these collaborative patterns influence peer-to-peer creative knowledge transfer, including sharing of strategies, concepts, and visual design practices.
3. To explore how contextual factors—such as teacher scaffolding, access to devices, and digital citizenship policies—support or constrain AI-driven collaborative creativity.
4. To generate design implications for an AI-driven collaborative learning ecosystem that can enhance student creativity in visual arts education in the GTA.

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III. Methodology

Research Design

A mixed-methods design was adopted to capture both the observable collaboration patterns and students' subjective experiences of creative knowledge sharing. The study combined:

- Classroom observations of AI-supported visual arts projects.
- Student questionnaires (including Likert-scale and open-ended items)
- Semi-structured focus group interviews with selected students and teachers

This design reflects constructivist and sociocultural perspectives, which emphasize learning as socially mediated and deeply embedded in shared activity and tools.

Setting and Participants

The study focused on secondary schools in the Peel and Toronto Regions of the Greater Toronto Area, where boards were exploring responsible use of AI in classrooms while developing or refining policies. Purposeful sampling was used to select schools that:

- Offered visual arts courses in grades 10–12.
- Had at least one teacher who had begun integrating generative AI tools into project-based learning.
- Had adequate access to devices and internet connectivity for AI use.

Within these schools, intact class groups of grades 10–12 students participated in the AI-mediated visual arts projects, reflecting normal classroom composition.

Tools and Learning Tasks

The primary generative AI tools observed were:

- Adobe Firefly, used for image generation and style transfer from text prompts.
- Canva's Magic Media, used for AI-assisted visual content creation and refinement within design templates.

Teachers designed multi-week visual arts projects (e.g., identity posters, community-themed campaigns, speculative future cityscapes) in which students worked in small groups (3–5 members) and were explicitly encouraged to negotiate prompts, critique outputs, and iteratively refine AI-generated images.

IV. Data Collection

1. Classroom Observations

- Structured observation protocols focused on patterns of interaction (e.g., who controls the keyboard, how prompts are negotiated, how images are critiqued and revised).
- Field notes captured episodes of collaborative problem-solving, conflicts, and moments of creative insight.

2. Student Questionnaires

- Items measured perceived creativity, role preferences in group work (e.g., "prompt engineer," "visual editor," "idea generator"), and perceptions of peer learning.
- Questions probed the extent to which students felt they learned new artistic concepts, vocabulary, and techniques from peers when working with AI.

3. Focus Groups

- Student focus groups explored how AI changed group dynamics, who was seen as "expert," and how ideas travelled within and between groups.
- Teacher interviews documented instructional intentions, ethical considerations, and perceived shifts in classroom collaboration.

Data Analysis

Qualitative data (field notes, open-ended survey responses, interview transcripts) were coded inductively and then organized into themes related to collaborative patterns and knowledge transfer. Observed interaction sequences were mapped to identify recurring collaboration structures (e.g., one student handling prompts while others critique). Quantitative questionnaire data were analyzed descriptively to characterize trends in student perceptions of creativity, AI use, and peer learning.

V. Findings

Emergent Collaborative Learning Patterns

Analysis across classes revealed several recurring AI-mediated collaborative patterns:

1. *Prompt Co-Design Pairs* Students frequently formed pairs in which one student typed prompts while another suggested refinements, styles, and constraints, leading to rapid iterative exploration of visual possibilities. This pattern was especially visible when groups needed to align images with conceptual themes (e.g., identity, community).

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2. *Iterative Critique Circles* Groups often gathered around a shared screen to evaluate AI-generated images, with students proposing modifications, alternative prompts, or compositional changes. These critique sessions mimicked traditional studio critique but were accelerated by AI's ability to quickly produce new variants.
3. *AI-Facilitated Expert–Novice Mentoring* Students with stronger digital or artistic skills (e.g., knowledge of art styles, design principles) often took on informal mentoring roles, helping peers craft more nuanced prompts and interpret AI outputs. AI became a shared reference point that made expert reasoning more visible and explainable.[
4. *Division of Labour Around AI and Manual Work* Some groups split tasks so that certain students focused on AI-generated imagery while others specialized in layout, typography, and hand-drawn enhancements. This division of labour allowed students with different strengths to contribute meaningfully.
5. *Surface-Level Delegation to AI* In some groups, AI was used to generate quick images with minimal discussion or refinement, resulting in weaker collaborative engagement and limited knowledge exchange.

Influence on Peer-to-Peer Creative Knowledge Transfer

The identified patterns influenced creative knowledge transfer in several ways:

- *Shared Creative Vocabulary and Concepts* Prompt co-design and critique circles promoted explicit talk about artistic styles (e.g., surrealism, impressionism), composition, and visual metaphors, helping students internalize and share conceptual knowledge.
- *Modeling of Creative Strategies* Expert–novice mentoring made tacit skills—such as decomposing a theme into visual elements or iteratively refining prompts—visible to less experienced peers, supporting the diffusion of creative strategies.
- *Amplification of Idea Diversity* The speed of AI generation allowed groups to explore multiple directions, compare variants, and remix peers' ideas, leading to richer collective ideation in many cases.
- *Risk of Narrowing Participation* When a single student controlled the AI interface or when groups leaned heavily on AI defaults, other members sometimes became passive spectators, limiting their opportunities to learn and contribute creatively.
- *Strengthening of Meta-Cognitive Reflection* In higher-functioning groups, students discussed not only what images looked "good," but also why certain prompts worked better than others, fostering metacognitive awareness of their creative processes.

Contextual Enablers and Constraints

- *Teacher Scaffolding* Classes where teachers explicitly framed AI as a collaborative "third partner" and required documentation of prompt iterations and rationale showed stronger collaborative engagement and knowledge sharing.
- *Policy and Ethics Climate* Peel and Toronto boards' emphasis on responsible technology use and digital citizenship shaped classroom expectations around respectful, ethical AI use, although formal AI-specific policies were still emerging.
- *Access and Infrastructure* Availability of devices, reliable internet, and licensed AI tools significantly influenced how widely and deeply AI could be integrated into group work.

Analysis of Findings

The emergent collaboration patterns align with sociocultural accounts of learning as participation in shared activity mediated by tools, with generative AI acting as a powerful cultural artifact that reorganizes interaction. Prompt co-design and critique circles reposition students as co-authors of both textual prompts and visual outputs, supporting shared ownership of the creative process and distributing expertise within the group.

These patterns also resonate with research suggesting that generative AI can enhance innovation capability and creative problem-solving when used interactively rather than passively. In classes where AI was integrated into iterative cycles of ideation, critique, and revision, students appeared to gain not only technical skills with tools like Adobe Firefly and Canva but also conceptual understanding of style, symbolism, and composition.

However, the findings highlight equity concerns. Without intentional design, AI can reinforce existing hierarchies—digital experts dominate interfaces and prompt writing, while quieter or less confident students become observers rather than active co-creators. These dynamic risksnarrow the scope of creative knowledge transfer to a subset of students, undermining the inclusive potential of an AI-driven collaborative ecosystem.

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Furthermore, the observed "surface-level delegation" pattern—where groups relied on AI to produce images with minimal discussion—indicates that generative AI can also support low-effort shortcuts if not anchored in strong pedagogical framing. This aligns with broader concerns in Canadian education about AI being used to bypass rather than deepen learning.

Synthesis

Synthesizing across data sources, the study suggests that generative AI in visual arts does not inherently determine collaboration quality; rather, it amplifies the underlying pedagogical design, classroom culture, and student roles. When embedded in structured group tasks that require:

- joint prompt design,
- iterative collective critique, and
- explicit sharing of reasoning and strategies,

AI use tends to generate rich collaborative learning patterns that promote peer-to-peer creative knowledge transfer. Under these conditions, AI functions as a catalyst for creativity, allowing diverse students to contribute ideas, test variations, and articulate artistic concepts in ways that might be harder with purely manual media.

Conversely, when AI is introduced without clear expectations for collaboration, role rotation, or reflection, it can encourage superficial group work and reproduce inequalities in digital and creative confidence. Thus, moving toward an AI-driven collaborative learning ecosystem requires intentional orchestration of tasks, tools, and roles, not merely providing access to AI platforms.

VI. Conclusion

For grades 10–12 students in Peel and Toronto Region schools in 2025, generative AI tools such as Adobe Firefly and Canva's Magic Media can reshape collaborative learning in visual arts by enabling new patterns of interaction centered on prompt engineering, rapid iteration, and shared critique. These patterns—particularly prompt co-design pairs, critique circles, and AI–mediated expert–novice mentoring—appear to support robust peer-to-peer creative knowledge transfer when coupled with strong teacher scaffolding and equitable participation structures.

However, the potential of these AI-driven collaborations is contingent on policies, infrastructure, and classroom practices that safeguard privacy, promote ethical use, and prevent the marginalization of less confident students.

For Major Nagra's broader thesis on enhancing student creativity through an AI-driven collaborative learning ecosystem, the findings underscore the need to design roles, routines, and reflective practices that position AI as a partner in creativity rather than a shortcut or replacement.

Future work could include more systematic measurement of creativity outcomes, longitudinal tracking of students' evolving collaborative dispositions, and participatory design with teachers and students to co-create AI-supported visual arts curricula tailored to the diverse communities of the GTA.

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