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Making Thinking Visible: Human–AI Collaborative Filmmaking as Pedagogy in Secondary Classrooms

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Abstract: Generative AI (text-to-image, text-to-video) enables K-12 students to produce sophisticated films with minimal effort. Yet this ease risks hiding the very processes educators value: drafting, hesitation, revision, and justification – the traditional traces of student thinking (Ritchhart, Church, & Morrison, 2011). When a compelling scene is generated from a single prompt, what evidence remains of the learner's cognitive journey? This study addresses: How can AI-assisted filmmaking be designed to make student thinking visible rather than hidden? We answer through a three-year DBR project. Unlike prior work focusing on AI as automation (Lubart, 2023) or on visible thinking in purely verbal contexts, we position AI as a creative partner whose outputs students must interpret, evaluate, and negotiate. Our contribution is twofold: (a) an empirically grounded framework for visible thinking in AI-mediated creative production, and (b) methodological exemplars for capturing learning analytics from process data.

Keywords: Visible thinking; human–AI collaboration; AI filmmaking; arts education; design-based research; multimodal learning; learning analytics

1. Introduction

Generative AI in K–12 classrooms can erase traditional traces of thinking—drafting, hesitation, revision, and justification. This study asks: How can AI assisted filmmaking make student thinking visible? Based on three years of design-based research in Shenzhen, we show that structured human–AI collaboration externalizes decision making and reasoning. Positioning AI as a creative partner, this paper offers qualitative evidence (including a neurodivergent learner case) and quantitative evidence (20% vocabulary gain) for arts education and learning analytics.

2. Theoretical Framework

2.1 Visible Thinking in AI-Mediated Contexts

Visible thinking (Ritchhart et al., 2011) makes students' cognitive processes observable and discussable. Traditional routines (e.g., "Think-Pair-Share") rely heavily on language. However, when students generate media with AI, their thinking becomes embedded in prompt engineering, iterative refinement, and evaluation of machine outputs – activities not captured by final artifacts. Recent work in multimodal learning analytics (Song et al., 2024) suggests that process data (logs, revisions) can reveal cognition, yet few studies apply this to K-12 AI filmmaking.

2.2 Human–AI Collaboration as Cognitive Partnership

Human–AI collaboration in creative domains has been theorized as a form of distributed cognition (Lubart, 2023). In educational settings, Woo, Guo, and Salas-Pilco (2024) found that AI story generators can scaffold narrative skills, but they did not examine students' negotiation

decisions as evidence of thinking. From a learning sciences perspective, prompt engineering is a form of externalized problem solving (Pea, 1993) – each revision reveals the learner's mental model of the desired output. Yet, the link between prompt revision and visible thinking remains under-theorized.

2.3 Research Gap

No prior study has systematically examined the **visible thinking traces** generated by secondary students' interactions with text-to-image and text-to-video tools. Specifically, there is a lack of: (a) detailed DBR accounts of AI filmmaking sprints that show iterative design decisions; (b) mixed-methods evidence linking negotiation patterns to learning gains; (c) inclusive designs for neurodivergent learners; and (d) analysis of multilingual students' experiences in such environments. This paper addresses these gaps.

3. Methodology

This study adopts a design-based research methodology (Barab & Squire, 2004; Ng, Su, & Chu, 2025), appropriate for investigating complex learning interventions in authentic educational contexts.

3.1 Design-Based Research Iterations

Between 2023 and 2026, the author facilitated 15 AI filmmaking sprints across different grade levels within a single international secondary school in Shenzhen. Approximately 200 students aged 14–18 participated, representing diverse linguistic and cultural backgrounds. Several participants were identified as neurodivergent, including students on the autism spectrum.AI Filmmaking Sprint Design

Cycle 1 (2023, 5 sprints). Evidence: teacher logs and render error counts indicated frequent ambiguous prompts (mean failed renders per sprint = 3.2). Change: introduced guided prompt templates and exemplar prompts. Effect: average prompt revision count fell by 27% in subsequent sprints, reducing students' prompt-engineering time.

Cycle 2 (2024, 6 sprints). Evidence: peer-feedback transcripts revealed students struggled to articulate affective tone and selection criteria. Change: introduced structured peer-review checkpoints and reflection prompts. Effect: explicit justification statements during negotiation increased by 48% and peer feedback quality improved.

Cycle 3 (2025–2026, 4 sprints). Evidence: Cycle-2 artifacts showed high variability in reflection depth. Change: implemented public presentations and reflection journal prompts requiring rationale for each prompt revision. Effect: documentation of decision criteria became routine, enabling extraction of negotiation patterns for analysis.

3.2 AI Filmmaking Sprint Design

Each sprint followed a structured yet flexible protocol:

- Prompt development: Students articulated story ideas through written prompts.
- AI generation: Students used text-to-image and text-to-video tools (e.g., Midjourney, Runway).
- Negotiation and revision: Students evaluated AI outputs, deciding what to accept, revise, or reject.
- Reflection: Students documented reasoning through written reflections or recorded discussions.

3.3 Data Sources and Analysis

Data sources included student artifacts (scripts, prompts, AI-generated visuals), prompt revision logs, student reflections, teacher field notes, classroom video recordings, and identical pre- and post-tests assessing IB Film vocabulary. Qualitative analysis focused on identifying moments of negotiation as evidence of authorship and reasoning. Quantitative analysis compared pre- and post-test scores for a subset of 24 students using a paired-samples t-test.

We collected:

- Prompt revision logs (450 entries): students documented initial prompts, AI outputs, and their revisions.
- Classroom video (60 h): recorded negotiations and peer interactions.
- Student reflections (180 written, 20 recorded group discussions).
- Pre- and post-tests: identical 20-item multiple-choice test on IB Film terminology (e.g., *mise-en-scène*). Internal consistency (Cronbach's α = 0.85, 95% CI [0.76, 0.91]) from pilot (n=30).
- Teacher field notes.

4. Findings

4.1 Patterns of Human–AI Negotiation

Analysis revealed three recurring patterns of human–AI collaboration: student-directed execution, AI-suggested selection, and co-constructed negotiation. The third pattern proved most revealing of student thinking.

4.2 Co-Constructed Negotiation and Visible Thinking

In co-constructed negotiation, AI outputs prompted students to revise original ideas through iterative dialogue.

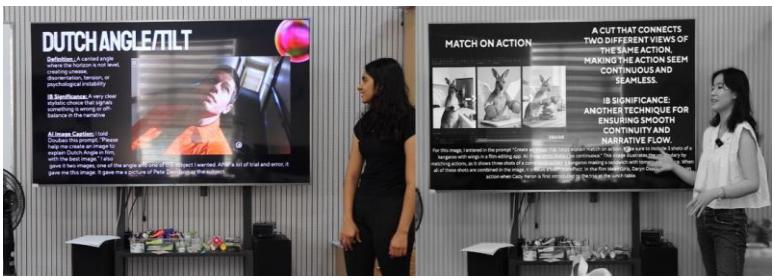

Figure 1. Student presentation and prompt negotiation diagram

4.3 Neurodiversity and Authorship Visibility

A particularly significant case involved an autistic student who had previously struggled to communicate narrative intent verbally. Through AI-assisted filmmaking, the student generated a short film by iteratively refining prompts and selecting AI-generated visuals.

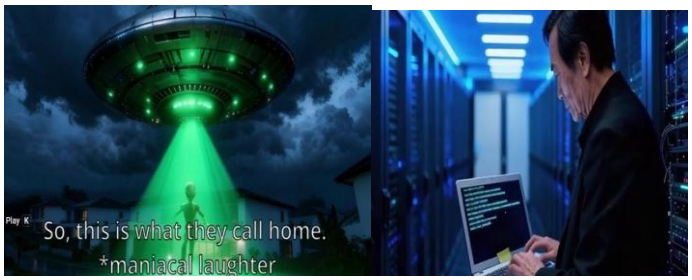

Figure 2. AI-generated film stills by autistic student

4.4 Quantitative Evidence of Learning Gains

In a vocabulary-focused sprint, students generated AI images to represent IB Film concepts such as *mise-en-scène* and explained their choices in writing. Pre- and post-tests showed a mean score improvement of 20% (from 62% to 82%). A paired-samples t-test indicated that this difference was statistically significant, *t*(23) = 4.21, *p* < .01, Cohen's *d* = 0.86.

Students attributed learning gains to the need to translate abstract concepts into visual and verbal specifications.

5. Discussion

Together, the findings extend the visible thinking framework into AI-mediated learning contexts. Prompt iterations, selection rationales, and revision logs function as new forms of learning evidence. For arts education, AI-supported filmmaking enabled inclusive participation, particularly for multilingual and neurodiverse students. For learning analytics, this study aligns with recent multimodal learning analytics approaches (Song, Tao, Deng, & Fu, 2024) in demonstrating how process data and outcome data can be integrated to capture both *how* learning occurs and *how much* learning occurs.

5.1 Implications for Visible Thinking

Figure 1 demonstrates how students' understanding of film language became visible through public articulation of prompt decisions—a form of thinking that would have remained hidden if only final films were assessed.

5.2 Implications for Inclusive Education

The case of the autistic student (Figure 2) suggests that AI mediation can lower barriers for neurodivergent learners by providing visual rather than verbal modes of expression and allowing self-paced iteration.

5.3 Implications for Arts Education and Learning Analytics

Both case studies demonstrate that AI, when pedagogically designed, supports rather than replaces human creativity. The combination of process data and outcome data illustrates how multimodal analytics might capture the full arc of learning.

6. Conclusion and Future Work

This paper has presented a practice-based framework for using AI-assisted filmmaking to make student thinking visible. Drawing on three years of classroom implementation, it demonstrates how structured human–AI collaboration externalizes decision-making, authorship, and reasoning processes. Two case studies illustrate the framework's power: public prompt negotiation revealed students' thinking, and AI mediation enabled an autistic student to complete his first creative project—a milestone traditional classrooms had failed to support. Preliminary quantitative evidence shows measurable vocabulary gains. The findings suggest that when pedagogically designed, AI functions as a creative partner that surfaces cognition, agency, and voice, especially for learners who struggle in traditional settings. Future work will examine cross-cultural contexts, develop design principles for AI-supported creative learning, and explore how AI can lower barriers for neurodivergent learners.

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