

Enhancing Thai Students' Coding and Creativity Through *Minecraft*-Based Game Learning: A Thematic Analysis of Student Reflections

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The Asian Conference on Education & International Development 2026
Official Conference Proceedings

Abstract

This study investigates how game-based learning (GBL) through *Minecraft: Education Edition (M:EE)* enhances coding and creative thinking among Thai primary school students. While prior research has often focused on quantitative outcomes or curriculum integration, this study emphasizes student voice by exploring learners' reflections on their experiences within a GBL environment. Drawing on the qualitative component of a larger mixed-methods project, the research analyzes written reflections from 284 Grade 4 students at a public laboratory school in Bangkok, Thailand, after completing an 8-week *M:EE*-integrated curriculum. Using thematic analysis, the study identifies three overarching themes: (1) students experienced coding as both challenging and enjoyable, particularly when visual feedback and in-game interactivity helped demystify abstract programming concepts; (2) students expressed a high degree of creative freedom through open-ended design tasks, taking ownership of their learning by building personalized digital artifacts; and (3) collaborative learning within the game environment contributed to increased digital confidence, teamwork skills, and peer-to-peer support. The findings highlight the potential of sandbox-based GBL platforms like *M:EE* to create learner-centered environments that support both technical and imaginative competencies. They also underscore the importance of reflective practices in understanding how students perceive and internalize coding and creative thinking processes. Implications are discussed for instructional design, teacher professional development, and the localization of educational technologies in non-English-speaking contexts. This research contributes to the growing literature on educational games by offering qualitative insight into the lived experiences of young learners navigating coding, creativity, and collaboration in digital spaces.

Keywords: *Minecraft: Education Edition*, game-based learning, student reflections, coding skills, creative thinking, thematic analysis

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Introduction

In today's rapidly evolving digital landscape, coding and creative thinking have emerged as foundational skills that are essential for success in both academic and professional contexts. In response, many educational systems—including Thailand's—have incorporated computational thinking into national curricula to better equip students for future challenges (IPST, 2018; Ministry of Education [MOE], 2023). However, traditional classroom instruction often struggles to engage students with abstract programming concepts, particularly among younger learners (Kafai & Burke, 2014).

Game-based learning (GBL) has gained attention as an effective pedagogical approach to foster student engagement and facilitate deeper learning. By integrating educational content with game mechanics, GBL promotes intrinsic motivation, critical thinking, collaboration, and problem-solving skills (Plass et al., 2015; Qian & Clark, 2016). Among GBL platforms, *Minecraft: Education Edition (M:EE)* stands out due to its open-ended, immersive environment that supports both technical and creative skill development (Alawajee & Delafield-Butt, 2021; Klimová et al., 2021).

M:EE has been adopted in various educational contexts to support subjects such as science, mathematics, and computer science. It is particularly effective in teaching coding and fostering creative thinking through sandbox-style gameplay that allows students to design, build, and collaborate in a virtual space (Bile, 2022; Sripan & Manyam, 2025). However, implementing *M:EE* in non-English-speaking contexts, such as Thailand, presents additional challenges—including language barriers and digital fluency—that can affect students' learning experiences and outcomes (Sripan & Manyam, 2025; Warschauer, 2003). Previous studies on *M:EE* have predominantly focused on measuring quantitative improvements in students' computational thinking or coding test scores. Yet fewer have explored how students reflect on their own learning processes in these environments—particularly in relation to their personal growth in creativity, collaboration, and digital confidence.

Research Gap

Although numerous studies confirm the effectiveness of *M:EE* in enhancing coding and creative skills, there remains a lack of in-depth, qualitative research exploring how students reflect on their learning experiences in game-based environments. In the Thai educational context, where *M:EE* is still relatively new, understanding students' subjective experiences is crucial for adapting pedagogical strategies and addressing contextual challenges. This study contributes to that gap by analyzing student reflections through a thematic lens to better understand how GBL via *M:EE* supports holistic skill development among primary school learners.

Objective

This study aims to address that gap by conducting a thematic analysis of student reflections from a large-scale implementation of *M:EE* in a Thai primary school. Through this qualitative lens, the research investigates how game-based learning impacts students' perceptions of coding, creativity, and collaborative learning.

Literature Review

Game-Based Learning and 21st Century Skills

Game-Based Learning (GBL) has become a widely adopted pedagogical approach aimed at increasing student motivation and engagement. Research shows that GBL can foster both cognitive and affective learning outcomes by embedding educational content in interactive, playful experiences (Plass et al., 2015). GBL has been shown to promote a range of essential 21st-century competencies, including critical thinking, problem-solving, collaboration, and digital literacy (Qian & Clark, 2016). The integration of game mechanics—such as rewards, progression, and instant feedback—encourages sustained engagement and enables learners to develop conceptual understanding through practice and iteration (Hamari et al., 2016).

Minecraft: Education Edition in Learning Contexts

Minecraft: Education Edition (M:EE), a classroom-adapted version of the popular sandbox game, has gained recognition as a powerful GBL tool. It offers open-ended gameplay and structured lesson templates designed to support subject-specific learning across disciplines such as science, history, mathematics, and computer science (Nebel et al., 2016). A growing body of research demonstrates *M:EE*'s effectiveness in enhancing student motivation and learning outcomes, particularly in STEM-related fields (Dezuanni, 2018; Klimová et al., 2021).

The unique features of *M:EE*—such as its Code Builder interface, collaborative multiplayer mode, and visual feedback system—allow students to engage with programming in intuitive and meaningful ways (Kafai & Burke, 2014). Several studies highlight *M:EE*'s role in developing computational thinking, as it allows students to explore coding concepts through design challenges and creative construction tasks (Bile, 2022; Kutay & Oner, 2022). Students benefit from experimenting within a low-stakes environment that emphasizes problem-solving, iteration, and self-expression.

Creative Thinking Through Sandbox Environments

Creative thinking, defined as the ability to generate novel and useful ideas, is increasingly seen as a core educational outcome (Sawyer, 2007). Digital sandbox games like *Minecraft* offer a fertile ground for developing this skill. By providing open-ended tasks, limited constraints, and opportunities for self-directed learning, *M:EE* encourages students to explore possibilities, take intellectual risks, and design innovative solutions (Clark & Ernst, 2020). Prior research has found that students engaged in *M:EE*-based activities often demonstrate increased originality, aesthetic awareness, and elaboration in their work (Alawajee & Delafield-Butt, 2021).

In collaborative settings, the platform also fosters social creativity by allowing students to co-create digital artifacts, share perspectives, and refine their designs through dialogue and negotiation. These activities reflect key elements of Vygotsky's (1978) social constructivist theory, which emphasizes the role of social interaction in cognitive development.

Student Reflections in Digital Learning Research

While many GBL studies focus on learning outcomes through test scores, less attention has been given to student reflections as a lens for evaluating learning experiences. Reflections provide valuable qualitative insight into learners' perceptions of their growth, challenges, and

preferences (Ryan, 2013). In GBL environments, reflections help capture affective dimensions of learning—such as enjoyment, confidence, and engagement—as well as metacognitive development. Sripan and Manyam (2025) conducted a large-scale implementation of *M:EE* in a Thai primary school and analyzed both performance data and students' written reflections. They found that students reported increased enjoyment in learning programming, enhanced creativity in designing virtual structures, and stronger collaboration skills. The authors emphasized the importance of examining student voice to improve instructional design and platform integration—particularly in non-English-speaking contexts, where language barriers and digital fluency may impact learner experiences.

Methodology

Research Design

This study employed a qualitative research design using thematic analysis to explore how game-based learning (GBL) through *Minecraft: Education Edition (M:EE)* influences students' perceptions of coding and creative thinking. The research focused on analyzing students' written reflections after participating in an 8-week learning program that integrated *M:EE* into the computer science curriculum. Thematic analysis was chosen for its ability to identify, analyze, and report recurring patterns of meaning within qualitative data (Braun & Clarke, 2006).

Research Context and Participants

The study was conducted at Kasetsart University Laboratory School Center for Educational Research and Development, a public demonstration school in Bangkok, Thailand. A total of 284 fourth-grade students (aged 9–10) participated in the research during the second semester of the 2023 academic year. All students had previously been introduced to basic coding concepts through Scratch but had no prior experience with *Minecraft: Education Edition*.

Students participated in an 8-week *M:EE*-integrated curriculum designed to enhance coding and creative thinking skills. Throughout the course, students engaged in activities such as block-based programming, problem-solving tasks, and creative digital design projects. Written reflections were collected at the end of the program to gain insight into students' learning experiences.

Data Collection

The primary data source for this study consisted of students' written responses to an open-ended reflection questionnaire administered at the end of the 8-week program. The reflection prompt asked students to describe what they had learned, what challenges they faced, and what aspects they enjoyed or found meaningful. In total, 654 individual reflections were collected from the 284 participating students.

The reflection activity was conducted in a classroom setting, with students given 20–30 minutes to respond. Responses were written in Thai and later translated into English for analysis. To preserve the authenticity of student voice, translations were carefully verified by bilingual researchers with expertise in educational technology.

Data Analysis

The data were analyzed using the six-phase framework for thematic analysis proposed by Braun and Clarke (2006):

1. Familiarization with the data: Researchers read and re-read the translated reflections to gain an initial understanding of the content.
2. Generating initial codes: Significant features of the data were systematically coded using QDA Miner Lite, a qualitative data analysis software.
3. Searching for themes: Codes were grouped into potential themes that captured patterns across the dataset.
4. Reviewing themes: Emerging themes were refined to ensure coherence and consistency with the coded extracts and the overall data.
5. Defining and naming themes: Each theme was clearly defined to capture its essence and relevance to the research questions.
6. Producing the report: The final themes were supported with illustrative student quotes and interpreted in relation to the literature.

Throughout the process, multiple rounds of coding and discussion were conducted among the research team to ensure analytical rigor, reduce bias, and enhance trustworthiness. Reflexivity was maintained through journaling and memoing, and discrepancies in interpretation were resolved through collaborative deliberation.

Trustworthiness and Ethical Considerations

To ensure the trustworthiness of the study, the following strategies were employed:

- Credibility: Data triangulation was achieved by comparing findings across multiple classrooms. Member checking was conducted by consulting participating teachers regarding the interpretation of themes.
- Transferability: Thick descriptions of the research context and participant demographics were provided to allow readers to assess the applicability of findings in other contexts.
- Dependability and Confirmability: An audit trail of the coding process, theme development, and analytic memos was maintained.

This research was approved by the Research Ethics Committee of Kasetsart University (Protocol ID: COE66/100). Informed consent was obtained from students and their legal guardians. All student data were anonymized and stored securely in accordance with ethical research standards.

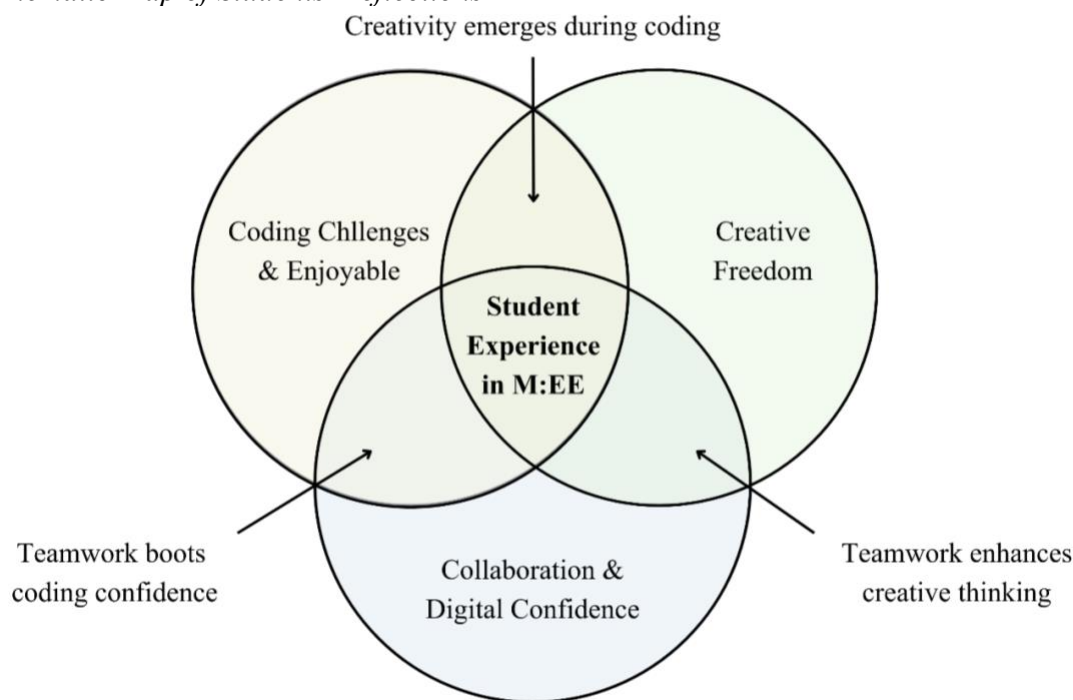
Findings

Thematic analysis of 654 student reflections revealed three major themes that captured the essence of students' experiences while learning through *Minecraft: Education Edition (M:EE)*: (1) Coding is Challenging but Enjoyable, (2) Creative Freedom in a Virtual World, and (3) Collaboration and Digital Confidence. Each theme highlights how game-based learning shaped students' perceptions of coding, creativity, and teamwork. Table 1 summarizes the thematic structure and Figure 1 presents a conceptual map of the findings.

Table 1*Summary of Identified Themes and Descriptions*

Theme No.	Theme Title	Description
1	Coding is Challenging but Enjoyable	Students found coding difficult at times but enjoyed the game-like environment and feedback.
2	Creative Freedom in a Virtual World	<i>M:EE</i> allowed students to freely design imaginative creations, fostering creative expression.
3	Collaboration and Digital Confidence	Students gained teamwork skills and became more confident using digital tools.

Table 1 summarizes the three key themes identified from students' reflections. Each theme represents a distinct dimension of their learning experience with *Minecraft: Education Edition (M:EE)*, including perceptions of coding, creativity, and collaboration. The descriptions highlight how learners navigated challenges, expressed creativity, and developed confidence through teamwork and digital interaction.

Figure 1*Thematic Map of Students' Reflections*

This Venn diagram illustrates the three overarching themes identified from students' reflections—Coding Challenges & Enjoyable, Creative Freedom, and Collaboration & Digital Confidence. The intersections reveal how these themes interact to shape student experience in *M:EE*. For example, creativity often emerges during coding, while teamwork contributes to both digital confidence and creative thinking. The central overlap highlights the holistic nature of learning in a game-based environment, where technical, imaginative, and social skills are developed simultaneously.

Theme 1: Coding is Challenging but Enjoyable

Students widely reported that coding was both difficult and enjoyable. Many had never used coding commands in English, and found syntax confusing. However, the game-based format of *M:EE* helped reduce frustration by offering immediate feedback and visual cues.

“Sometimes I didn’t know what the code meant, but when I saw the Agent move, I felt excited and wanted to try again.” (*Student A*)

Despite struggling, students valued the problem-solving process and enjoyed seeing their code translated into real-time actions in the game world.

“At first I didn’t understand, but I clicked around and suddenly the Agent did what I wanted—then I felt like a coder!” (*Student B*)

Theme 2: Creative Freedom in a Virtual World

M:EE's sandbox environment encouraged students to express their imagination freely. Students described designing houses, landscapes, and environments that reflected personal ideas—some even modeled structures after dream homes or fantasy settings.

“I made a three-story house with a sky garden and a secret lava trap inside. It was something I could never build in real life!” (*Student C*)

The open-ended tasks allowed students to experiment without fear of failure, which is a core component of creative development. Students also mentioned feeling proud of their unique creations, often elaborating on small details such as lighting, color patterns, and logic-based doors.

Table 2

Student-Created Objects in Creative Projects (Selected Examples)

Object Designed	Student’s Description	Creativity Indicators
Floating pink castle	“Made from glass blocks with rainbow roof and garden”	Novelty, color use, imagination
Underwater aquarium house	“Fish can swim through the living room”	Integration of biology and art
Roller coaster with traps	“Used redstone to make a loop-de-loop trap!”	Technical innovation, logic

This table presents selected examples of student-designed digital objects created during the final project phase. Each creation reflects how learners applied imagination, design logic, and interdisciplinary thinking through the sandbox environment of *Minecraft: Education Edition (M:EE)*. The student descriptions illustrate their sense of ownership and engagement with the platform. These examples also reveal diverse creative strategies—ranging from aesthetic design to technical problem-solving—emerging through play-based learning.

Figure 2

Examples of Students' Work



Examples of Students' Work: These screenshots display student-designed virtual structures created during the final project phase of the *M:EE*-integrated curriculum. The designs reflect individual creativity, spatial reasoning, and collaborative problem-solving. Projects ranged from modern architecture to recreational zones, showcasing diverse interpretations of design goals.

Theme 3: Collaboration and Digital Confidence

A majority of students reflected on how they learned from their peers during group projects. The collaborative mode in *M:EE* facilitated teamwork, communication, and task delegation. Students reported sharing knowledge—especially in areas like using commands, building structures, and fixing bugs.

“My friend helped me with the code when I got stuck, and I helped him design the garden. It felt good to build something together.” (*Student D*)

Furthermore, many students mentioned how they felt more confident using a mouse, keyboard, and game interfaces after the project.

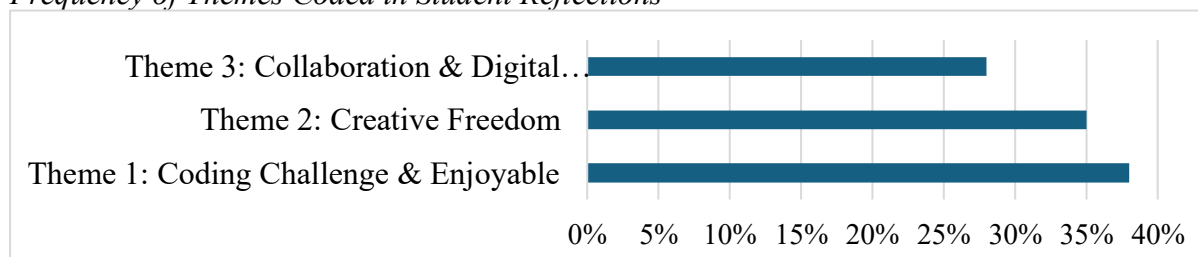
“I didn't know how to play *Minecraft* before, but now I can use the keyboard easily and even help my little brother at home.” (*Student E*)

Summary of Findings

Figure 3 illustrates a breakdown of student reflection frequencies by theme. Coding-related experiences were most frequently mentioned, followed by creativity and collaboration, highlighting students' engagement with both technical and social aspects of learning in *M:EE*.

Figure 3

Frequency of Themes Coded in Student Reflections



Interpretation

Together, these themes reveal that *M:EE* supports a learner-centered digital environment where challenges are mitigated by motivation, creative self-expression is empowered, and collaborative digital skills are strengthened. The reflections suggest that when coding is embedded in an engaging, flexible, and socially interactive platform, students are more likely to persist, experiment, and thrive.

Discussion

The findings of this study demonstrate that *Minecraft: Education Edition (M:EE)*, as a game-based learning (GBL) platform, effectively supports Thai primary students in developing both technical and creative skills. Through thematic analysis of 654 student reflections, three key areas emerged: the dual nature of coding as challenging yet enjoyable, the empowering effect of creative freedom in sandbox environments, and the growth of collaboration and digital confidence. These themes align closely with prior research on GBL and reinforce theoretical perspectives in constructivist and experiential learning.

Coding Engagement Through Playful Challenge

Students consistently described coding as both “difficult” and “fun,” suggesting that *M:EE* successfully transformed an abstract, often intimidating subject into an accessible and motivating experience. This supports earlier findings by Kafai and Burke (2014), who emphasized that playful programming environments reduce cognitive load and increase persistence in problem-solving.

M:EE's immediate visual feedback and intuitive interface allowed students to explore trial-and-error approaches, aligning with Kolb's (1984) experiential learning model, where learners actively construct knowledge through reflection on action. Although some students struggled with debugging tasks or English-based commands—a challenge also noted by Sripan and Manyam (2025)—the overall tone of reflections suggests that these struggles were framed as learning opportunities rather than barriers.

Creativity as Empowered Expression

The second theme underscores the transformative role of sandbox-based game environments in cultivating creativity. Students designed elaborate digital artifacts—such as sky gardens, underwater homes, and fantasy castles—that reflected not only imagination but also strategic thinking and self-expression. These findings echo studies by Clark and Ernst (2020) and Alawajee and Delafield-Butt (2021), which highlight how open-ended design tasks foster creative exploration and intrinsic motivation.

By removing rigid constraints often found in traditional classrooms, *M:EE* allowed students to take intellectual risks and iterate on ideas without fear of failure. This aligns with Amabile's (1983) theory of intrinsic motivation in creativity and validates the use of GBL environments to promote divergent thinking, aesthetic expression, and playful experimentation in young learners.

Collaboration and Digital Fluency

The third theme points to important gains in soft skills. Students reported learning from their peers, sharing strategies, and negotiating roles in group projects. These experiences reflect Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD), in which learners develop new capabilities through social interaction and guided participation.

The cooperative nature of *M:EE* supports Sawyer's (2007) idea of "group genius," where creativity emerges through collaboration. Additionally, the repeated mentions of increased digital confidence—such as improved mouse/keyboard skills or navigating interfaces—highlight the role of GBL in bridging the digital skills gap among young learners. This is particularly relevant in Thailand, where concerns about equitable access and digital literacy remain (Warschauer, 2003).

Addressing Limitations

While the positive impacts of *M:EE* are clear, challenges remain. Some students noted issues with platform bugs, login errors, or difficulty understanding English-based coding syntax. These findings align with previous studies (e.g., Sripan & Manyam, 2025) and suggest the need for more localized versions of *M:EE* or culturally adapted lesson materials.

Moreover, students showed varied preferences for task difficulty—some requested simpler tasks, while others desired more complexity. This supports the need for differentiated instruction and adaptive task design in GBL environments, as suggested by Plass et al. (2015).

Contribution to Literature

This study contributes to the growing body of research on GBL by emphasizing student voice. While much of the literature on *M:EE* focuses on learning outcomes measured through tests or observations, this research foregrounds how students feel and reflect on their learning. It provides qualitative evidence that GBL environments like *M:EE* can simultaneously develop technical, creative, and interpersonal skills—particularly when designed with intentional scaffolding and space for reflection.

Conclusion and Implications

This study explored how game-based learning (GBL) through *Minecraft: Education Edition* (*M:EE*) enhances coding and creative thinking among Thai fourth-grade students. By conducting a thematic analysis of 654 student reflections gathered after an 8-week *M:EE*-integrated curriculum, the research uncovered rich qualitative insights into how students experienced learning through play, collaboration, and digital design.

Three key themes emerged: students perceived coding as challenging but rewarding, valued the creative freedom offered by *M:EE*, and gained confidence in their digital and collaborative skills. These findings support existing literature on the benefits of GBL in promoting motivation, creativity, and problem-solving (Clark & Ernst, 2020; Plass et al., 2015). More importantly, the study emphasizes the power of student voice in shaping educational innovation—particularly in contexts where language, access, and digital fluency remain barriers.

Practical Implications for Educators

The results suggest that educators should consider integrating sandbox-based GBL tools like *M:EE* into the elementary computing curriculum, particularly to:

1. Enhance engagement in coding: Embedding coding tasks in meaningful, gamified contexts increases students' willingness to persist through difficulty.
2. Promote creativity: Open-ended building tasks foster divergent thinking and allow students to apply coding for imaginative purposes.
3. Build soft skills: Digital confidence, collaboration, and communication emerged naturally through team-based activities in *M:EE*.

Teachers can leverage reflection activities—not only as assessment tools but also as instruments for encouraging metacognitive awareness. Additionally, scaffolding in areas such as basic computer skills and vocabulary can help students navigate technical challenges more effectively.

Policy Recommendations

At a policy level, this study supports the growing call for technology-enhanced learning environments in Thai education. The following recommendations are proposed:

1. Curriculum designers should integrate GBL platforms like *M:EE* in computational thinking frameworks, aligned with the Ministry of Education's digital literacy goals (MOE, 2023).
2. Educational authorities should invest in teacher training to ensure educators are equipped to design, implement, and assess GBL effectively.
3. Platform developers should prioritize localization features, including multilingual support and culturally relevant content, to broaden access and reduce learning barriers.

Future Research Directions

While this study sheds light on how students perceive learning through *M:EE*, further research is needed to deepen understanding and expand applicability:

1. Longitudinal studies could examine the sustained impact of GBL on students' coding proficiency and creative development over time.
2. Comparative studies might evaluate *M:EE* against other GBL tools or traditional instruction to assess relative effectiveness.
3. Teacher perspectives could be explored to understand how educators adapt their pedagogy in response to student feedback and engagement in GBL settings.
4. Equity-focused research is also needed to assess how GBL impacts learners from different socioeconomic and language backgrounds.

In conclusion, *Minecraft: Education Edition* offers more than just a playful approach to coding—it provides a meaningful, learner-centered space where students can take ownership of their learning journeys. By listening closely to student reflections, educators and policymakers can better understand how to design digital learning environments that are not only technically effective, but also personally transformative.

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