Youth Constructions of the Future

Depictions of and Responses to AI on Scratch

J. K. Voorhis[1], and Paulo Blikstein[1, 2]

[1] Teachers College, Columbia University, USA
[2] Instituto Tecnológico de Monterrey, Mexico

Abstract

This study examines how youth engage with AI through Scratch projects, revealing how they depict, critique, and reimagine futures with AI. By analyzing 131 projects and 22,692 comments, we identified five representations of AI: Game Player, Conversational Agent, Learning Entity, Discussion Topic, and Creative Partner. Youth creators and commenters actively negotiate AI's meaning, envisioning futures where AI is playful, collaborative, or dystopian. Findings highlight the importance of constructionist learning environments for youths' collaborative sensemaking regarding emergent technology.

Keywords and Phrases: Artificial Intelligence, Constructionism, Scratch, CS

1. Introduction & Background

The emergence of publicly accessible artificial intelligence (AI) agents has rapidly accelerated the integration of AI into everyday technology. The current prevalence of AI technologies presents new opportunities to explore the vision of constructionist learning (Papert, 1980): empowering learners to create, share, and reflect on concrete projects that shape their understanding of technology and its societal implications. Platforms like Scratch (Scratch Foundation, n.d.-a) provide youth with an accessible way to experiment with AI concepts through interactive making. As youth engage with Scratch to create projects centered on the topic of AI, they act not only as learners of technical skills but also as philosophers of technology, grappling with AI's cultural, ethical, and creative dimensions through their designs.

1.1 Literature Review

Prior research examines both how youth develop conceptual understanding of AI systems and how constructionist environments like Scratch enable them to create with these technologies, fostering critical inquiry, technical literacy, and youth imaginings of AI's potential.

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Youth Understanding of AI

Youth engagement with AI reveals both challenges and opportunities for developing AI literacy. While students are typically curious about AI, they often struggle with abstract concepts like machine learning (Greenwald et al., 2021). Connecting to foundational math and computational thinking helps scaffold their understanding and make it more accessible.

Hands-on, iterative experiences enable youth to apply their understanding creatively and see themselves as active contributors to AI design. Research shows that exposing core AI processes, such as data labeling and evaluation, allows children to construct accurate mental models of typically "black boxed" AI procedures (Hitron et al., 2019). Similarly, through hands-on projects developing chatbots, youth demonstrate the value of interactive tools like conversational AI (Song et al., 2023). By interrogating systems such as algorithmic bias through media production with AI, young people deepen their technical understanding while also imagining more ethical uses of AI (Lee et al., 2022).

These studies suggest that effective AI education requires balancing technical knowledge with critically examining AI's societal impacts. When given appropriate scaffolding and authentic contexts, young people can not only grasp AI concepts but also meaningfully contribute to discussions about AI ethics and design. The literature emphasizes that youth understanding of AI develops most effectively when learning experiences are participatory rather than passive.

Constructionism, Scratch, and AI

The relationship between constructionism and AI has a long, intertwined history, connecting early AI research with constructionist learning (Kahn & Winters, 2021). This tradition encourages youth to build, experiment, and reflect while interacting with computational systems.

Scratch, a visual, block-based programming language, carries forward this constructionist vision by enabling young people to create interactive stories, games, and animations. As described on its official site, Scratch fosters creativity, collaboration, and computational literacy in a global online community (Scratch Foundation, n.d.-b). While Scratch's main platform does not yet feature AI tools, its beta "playground" site experiments with AI-powered blocks, signaling a possible move toward integrating machine learning and natural language processing into the programming environments

It has been shown that AI tools can enhance block-based programming in ways that align with Scratch's constructionist roots (Jordan et al., 2021; Reddy et al., 2021). These studies highlight how AI tools empower youth to explore and understand concepts like machine learning and algorithmic bias while fostering critical and creative inquiry. Through these innovations, constructionist tools like Scratch offer pathways for youth to demystify AI, reflect on its societal implications, and reimagine its potential through playful, hands-on creation.

Youth Creations envisioning AI futures

In examining how young people conceptualize and construct potential AI futures, we build upon the theoretical framework that positions youth as "philosophers of technology" (Vakil & McKinney de Royston, 2022) and leverage the "mediational means" afforded by constructionist learning environments (Ackermann, 2004).

Ackermann (2004) emphasizes that constructionism allows learners to externalize their thoughts into tangible forms that act as, in Papert's words, "objects-to-think-with" (1980). These artifacts act as "mediational means" for learners, facilitating space to explore new concepts and negotiate their meanings with peers.

At the intersection of creativity and critical inquiry, youth's AI creations reveal pathways for ethical and aesthetic contemplation. Vakil and McKinney de Royston (2022) suggest that such work positions youth to confront the relational and moral dimensions of technology, enabling them to decode its ties to power while envisioning more just and equitable futures. By creating projects that engage with AI, youth are not merely passive users or technical creators but are actively constructing "possible worlds" that challenge existing norms and bring into being alternatives grounded in care, creativity, and justice. Through this lens, young people's AI creations are powerful expressions of their capacity to reimagine and actively shape possible AI futures.

1.2 Research Questions

While experimental integrations of AI tools on platforms like Scratch present interesting case studies for understanding AI technology, little is known about how youth currently engage with AI in their projects without such built-in options. This study addresses this gap by exploring the projects on Scratch that youth create around AI, and the responses these projects elicit. These artifacts show how youth envision and respond to emerging AI technology. In this pursuit, we ask the following questions:

RQ1: *How are youth creators depicting AI technology through their projects on Scratch?*

RQ2: *How are youth commenters responding to AI projects on Scratch?*

2. Methods

This study aims to capture youths' emergent depictions of and responses to AI, without the researcher's presence interfering with the youths' processes (Kligler-Vilenchik & Literat, 2024). To achieve this, a qualitative content analysis of Scratch projects was conducted using thematic analysis. While demographic data is not available for individual Scratch users, the vast majority of users are under 25, with the most common age being 12 years old (Scratch Foundation, n.d.-c). Based on this information, it is reasonable to assume that projects included in this study were created by youth.

Although projects and comments are publicly accessible, the examples shared here have been anonymized as a further ethical precaution, as the users represented are likely minors (franzke et al., 2020). Usernames have been replaced with pseudonyms that aim to retain the original meaning and structure, while project titles and text have been slightly altered to prevent discoverability via searching.

2.1 Data Collection

To investigate how youth creators on Scratch represent AI, the first author first conducted a keyword search using the term "AI" and filtered for projects updated within the last five years, resulting in 147 identified projects. Next, the first author developed a Python script, using the Scratch Application Programming Interface (API), to retrieve metadata on each project and export the information as a CSV file that included: title, instructions, description (in the user interface this is labeled "notes and credits"), publication date, date last modified, username of creator, URL of project, number of likes, number of favorites, number of views, number of remixes from the project, and parent project if it was a remix of another project. A round of screening followed, during which the first author excluded 16 projects that were not authored in English (due language limitations of the author), lacked both a description and instructions, were unrelated to artificial intelligence (e.g., projects about an anime character named "Ai"), or appeared to be created by adults rather than youth (based on information posted on the user's public profile). After these eliminations, the dataset was reduced to 131 projects.

To examine responses to these projects, the first author then collected up to the 1,000 most recent user comments for each of the 131 projects. This yielded a total of 22,692 comments which were exported into a CSV file. Both project- and comment-level datasets were subsequently imported into a spreadsheet to facilitate sorting, filtering, keyword searches, and other organizational tasks.

2.2 Data Analysis

Following a thematic analysis approach (Braun & Clarke, 2006), analysis proceeded in several iterative phases to develop distinct but related coding frameworks for youths' projects and their comments on others' projects. To characterize the projects themselves, the first author first reviewed all projects' descriptions and instructions, and memoed toward developing a provisional coding frame of how creators depicted AI (e.g., "Game," "Chatbot," and "Path Learning"). The first author refined the provisional categories by comparing projects within each provisional category, attending to edge-cases, and re-examining projects that fit into multiple categories. Once overlapping categories were removed and a stable set of categories was established (Table 1), the first author applied them to all 131 projects.

Code	Definition	Example
Game Player	AI is depicted as a strategic agent, engaging in gameplay either autonomously or through direct interaction with users.	Chess opponent, racing game opponents, AI vs AI tag games
Conversational Agent	AI is portrayed as socially and linguistically responsive, simulating human-like dialogue and interactions.	Generic chatbots, virtual assistants
Learning Entity	AI is emphasized as having adaptive potential, showcasing agents that refine their actions through experience.	Iterative maze navigators, chatbots that users can "teach"

Code	Definition	Example
Discussion Topic	AI as a cultural and ethical subject rather than as a simulated agent.	Presentation projects (projects that operate as slideshows)
Creative Partner	AI is positioned as a co-creator, assisting in generating new ideas or images.	Storytelling assistant, image generator

Table 1: Project Codebook.

To characterize comments, the first author initially focused on up to the 1,000 most recent user comments on the most "loved" project within each provisional project category, reviewing the comments to identify patterns in user feedback, interpretations, and inquiries related to AI representations (e.g., "Entertained," "Curiosity," and "Ethical"). The first author then used their provisional comment categories to code the overall corpus of 22,692 comments, excluding comments that did not engage with the depiction of AI technology in the project (e.g., comments that simply reported a user's score on game projects, self-promotion for users' own projects, or random comments like "skibidi toilet"). Memoing was employed to capture emerging insights, clarify coding decisions, and inform subsequent refinements to the final categories (Table 2).

Code	Definition	Example
Definitional	Make claims about and actively negotiating what "counts" as AI	*Globus*: "This in NOT an AI at ALL. It is just loops of If, and else, no data, not TRUE data." *CrownKid*: "this is not ai. this is VI(virtual Intelligence) which has pre trained responses to specific questions."
"Doom!"	Frame AI as a source of threat or uncertainty, particularly when considering its future implications	*oceangirl8*: "this is insane, ai is literally taking over earth" *condorcan20*: "I mean I'm so afraid that ai will take over the world that I say thank you to siri"
Ethical Concern	Critique the use of AI-generated content and questioning the appropriateness of AI implementations in a youth-focused space	*Totoro_wott*: "of all thing why AI art? that's literally just stealing because they import other people's work" *Liberty_lad*: "it's scary how much AI blew up last year [...] I wouldn't be surprised if most people lose their jobs by next year"
"Cool!"	Celebrate AI's novelty and playfulness	*LegendaryGamer*: "Wow! This is very cool! I love machine learning!" *mashed_potat*: "this is such a cool game, i didn't realize you could make ai in scratch!!!"

Table 2: Comment Codebook.

3. FINDINGS

Our analysis revealed distinct patterns in how youth engage with AI on the Scratch platform, both as creators and as commenters.

3.1 RQ1: How are youth creators depicting AI technology through their projects on Scratch?

Youth on Scratch conceptualize AI in diverse ways, with the majority framing it within playful contexts. The predominant representation positions AI as a strategic opponent or teammate in games, reflecting youth's natural integration of AI concepts into familiar recreational formats. Other projects presented AI as entities capable of conversation and learning, demonstrating an understanding of adaptive capabilities and interactive potential.

Beyond functional applications, some creators used their projects as platforms for metacognitive exploration of AI's societal implications. A smaller but notable subset of projects positioned AI as a creative collaborator, suggesting an emerging view of AI as a tool that enhances rather than replaces human creativity.

3.2 RQ2: How are youth commenters responding to AI projects on Scratch?

The comment analysis revealed that youth are actively constructing meaning around AI through social interactions. Many comments focused on boundary work—collective negotiations about what qualifies as "real" AI—suggesting that youth are developing technical criteria for evaluating AI claims.

Emotional responses to AI projects ranged widely, from excitement about technological possibilities to apprehension about potential risks. These polarized reactions often coexisted within discussion threads, creating a dynamic community dialogue about AI's implications. Beyond binary responses, many commenters articulated nuanced perspectives that acknowledged both AI's potential and limitations. Ethical discussions were particularly noteworthy, with youth critically examining appropriate uses of AI-generated content and questioning implementation contexts.

These findings demonstrate that young people's engagement with AI on Scratch extends beyond technical experimentation to encompass social, cultural, and ethical dimensions, highlighting the platform's role as a space for collective sensemaking around emerging technologies.

4. Discussion

In this study, we have shown youth participating in the active construction of the enduring connection between Constructionism and the field of AI through their depictions and collaborative sensemaking of AI on Scratch. The findings from both projects and comments reveal how youth collectively construct and negotiate possible futures for AI, including visions of AI as entertainment, a partner, and a dystopia. These futures emerge not only through the ways AI is represented in projects but also through how commenters respond to and make sense of these representations.

Projects that frame AI as a Game Player reflect a future where AI functions as entertainment, seamlessly integrated into playful, interactive experiences. Here, AI is positioned as a strategic and responsive agent that enhances games, aligning with youthful interests in fun and exploration. Commenters who respond with excitement,

describing AI as "Cool!" and novel, reinforce this optimistic framing, celebrating the potential of AI to engage, amuse, and enrich recreational spaces. The Creative Partner and Conversational Agent categories highlight futures where AI acts as a partner, supporting human creativity and interaction. Projects that showcase AI as a collaborator—generating ideas, images, or dialogue—suggest a future where technology enhances human capacity for expression and relationship-building. Commenters who embrace these representations often focus on AI's potential to augment rather than replace human effort, positioning AI as a tool that broadens possibilities rather than diminishing agency. This vision of AI as a partner reflects an optimistic, cooperative relationship between humans and technology. At the same time, commenter apprehension, most visible in the "Doom!" responses, reflects a future where AI represents dystopia, evoking fear of its uncertain implications. Even in playful or creative projects, some participants interpret AI as a threat, suggesting anxieties about its disruptive potential and the risks of a technology they may not fully understand. This tension reveals how youth engagement with AI projects does not always inspire trust; instead, it can amplify broader societal concerns about control, ethics, and harm.

The goal of this study was to establish initial categories for future explorations into constructionist AI projects. Thus far, our findings suggest that when youth engage in collaborative sensemaking around AI in constructionist learning environments like Scratch, they imagine AI through multiple lenses, constructing futures that could be playful and interactive, collaborative, creative, or uncertain and threatening. The interplay between projects and comments highlights how youth actively negotiate these possibilities, demonstrating their ability to engage with AI not just as a technical tool but as a cultural and ethical phenomenon with far-reaching implications. By engaging in playful creation and critical inquiry, young people are *not only developing technical literacy but also positioning themselves as empowered agents who can shape technology's future.* For educators and policymakers, these findings underscore the importance of fostering constructionist learning environments that encourage youth to explore, critique, and reimagine the technologies that will define their world.

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