Emergent Technology, Emergent Critique: Students and Teachers Developing Critical AI Literacy Through Participatory Design Around Generative AI

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Abstract

Who gets to decide how generative AI tools enter students' classrooms? We report on a five-week participatory design program in which three 11th-grade Latinx students and three high school teachers in California negotiated how generative AI tools would be used and taught about in learning environments. Drawing on video recordings and designed artifacts, we ask: what critical AI literacy practices emerged as students and teachers jointly designed how generative AI tools would be used and taught about? Our analysis reveals three practices: collectively unsettling assumptions about AI, mutual learning through complementary expertise, and grounding AI critique in cultural knowledge and creative practice. Students and teachers developed these practices through the design work itself. This case contributes strategies for designing with youth around an emergent technology like generative AI toward critical AI literacy. It extends work on youth as protagonists by showing how this approach enables students to shape both the adoption and the interrogation of these tools in their learning environments.

CCS Concepts

• **Human-centered computing** → **HCI design and evaluation methods**; • **Social and professional topics** → *K-12 education.*

Keywords

critical AI literacy, participatory design, co-design, generative AI, high school, Latinx youth, AI literacy

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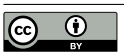
1 Introduction

Generative AI in education has the hallmarks of an emerging technology [41]: it is growing fast, its impact on learning is widely anticipated, and yet which tools enter classrooms, how, and toward what ends remains genuinely uncertain. As Frauenberger et al. [11] argue, when a technology is emergent, the stakeholders affected by the adoption of such technologies have a democratic claim to participate in shaping them. Thus, participatory design (PD) is essential to ensure that these systems are designed and deployed in ways that remain accountable to the needs and practices of those most directly impacted.

A growing body of research has worked to make AI legible to young people, helping them understand how these systems work and how to build with them [6, 13, 29], with researchers asking not just whether youth can learn AI, but whether they can engage with it as questioners of its design and use: interrogating whose data trains models, who bears the costs of algorithmic bias, and how technical systems encode societal inequities [1, 25, 46]. Prior studies have used participatory approaches to design how AI literacy gets taught [31, 38], but the question of who shapes which aspects of AI are worth questioning, and from whose social and community position, has gone largely unasked. Critical AI literacy [46] is precisely the orientation needed to ask it: not just how AI tools enter learning environments, but what about them deserves scrutiny, whose knowledge frames that scrutiny, and what it means to teach AI critically. In this paper, we examine what it produces when high school students bring that orientation as design protagonists, shaping how generative AI tools are used and taught about in their own learning environments.

We conducted a five-week PD program with three 11th-grade students and three high school teachers in a southern California city, in which each teacher-student dyad produced a curricular unit shaping how generative AI tools would be used and taught about in their subject area. Our descriptive case study addresses the following question: What critical AI literacy practices emerged as high school students and teachers jointly designed how generative AI tools would be used and taught about in their learning environments? Three practices emerged: (1) collectively unsettling assumptions about AI; (2) mutual learning through complementary expertise; and (3) grounding critique in cultural knowledge and creative practice. This paper contributes a situated case study with two interrelated claims: first, it offers strategies for PD around an emergent technology like generative AI, oriented toward fostering critical AI literacy practices; and second, it extends work on youth as protagonists [20, 24, 47] by showing what that positioning requires in formal education contexts, where generative AI is still emergent and teachers are co-designers. We show that when students hold genuine design authority in that setting, they shape not only how these tools are adopted but also what about them



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becomes an object of scrutiny and whose knowledge determines what gets taught.

2 Background

2.1 Critical AI Literacy as a Situated Practice

AI literacy has been conceptualized as a set of competencies enabling individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool in everyday life and work [28, 48]. Calls within computing education have pushed beyond competency frameworks to ask whose interests are served by what we teach about technology, and to make the ethical and political dimensions of computing available to all students [45]. Critical AI literacy extends this foundation by foregrounding the sociopolitical dimensions that conventional frameworks tend to underemphasize. Veldhuis et al. [46] synthesize critical AI literacy across four interrelated dimensions: disrupting the commonplace, or questioning taken-for-granted assumptions about AI in everyday life; considering multiple viewpoints, including those of marginalized communities; focusing on the sociopolitical, by analyzing how AI is entangled with power, inequality, and institutional structures; and taking action, by translating critical understandings into ethical and design-oriented interventions.

These dimensions describe orientations and objectives, leaving open the social processes through which they develop. Drawing on Lave and Wenger's [26] conceptualization of learning as situated participation in social practice, we understand critical AI literacy as something that emerges *through the doing*, through negotiations, decisions, and collective sense-making among participants. Aleman and Martinez [1, 2] showed that community situatedness was essential to how youth developed critical orientations toward AI; similar work in southern California communities has demonstrated how learners' cultural resources shape their engagement with AI concepts [39]. Logan [27] argued that learning about generative AI requires mapping its political-economic ecologies; empirical work by Durall et al. and Babai et al. has further documented how teenagers engage in ethical reflection when AI activities are embedded in school contexts [3, 12]. Together, these studies suggest that critical AI literacy emerges through participation in particular kinds of social activity [14, 18, 19]. We use Veldhuis et al.'s [46] four dimensions as our guiding lens.

2.2 Shaping AI Literacy Learning Environments Through Participatory Design

AI literacy frameworks center students as mindful users of AI [28]. Positioning them instead as designers of AI uptake [24] raises deeper questions: which tools enter their learning environments, what about them deserves scrutiny, and whose knowledge shapes what gets learned. CCI research has long been concerned with positioning youth as active designers of computing technologies [9, 16, 20, 22]. Iversen, Smith, and Dindler [21] proposed computational empowerment as a framework for how youth engage critically with technology through construction and deconstruction activities [20]. Iivari and colleagues [15, 17] have argued that truly empowering designs must embed critical and justice-oriented orientations from the outset, and a broader program of research has examined what conditions sustain that empowerment [7, 32, 42–44].

This critical turn within CCI has begun to shape how researchers approach AI literacy learning. Several studies have engaged youth as designers of AI systems, showing that critical and ethical understandings can emerge through the construction process itself [23, 33–36, 47]. Others have involved teachers as designers in PD processes around AI literacy, demonstrating that PD with educators increases agency and supports the integration of critical perspectives on AI into learning environments [4, 37]. Mawasi et al. [31] showed that when youth and educators design together, relations of expertise are redistributed and both parties learn from each other in ways neither anticipated. When PD has included students, they have been positioned as designers of AI systems or as advisors to teacher-led curriculum design [5, 38], leaving open the question of what it looks like when students shape the critical AI literacy learning space through PD. This is the gap our study addresses.

3 Methods

3.1 Participants and Context

We conducted an after-school PD program with three 11th-grade students and three high school teachers at a public high school in a southern California city, where 98% of students identify as Latinx. The students, Klaus, Sunny, and Violeta (two girls and one boy), were enrolled in courses taught by their teacher-collaborators: Duncan, a computer science teacher; Isa, a design teacher; and León, a social studies teacher. All names are pseudonyms.

3.2 Workshop Activities

The program consisted of five weekly co-design sessions of 90 minutes each, held between February and April. Each session followed a consistent three-part structure. Sessions opened with a critical-ethical icebreaker activity in which participants collectively discussed a sociotechnical dilemma related to AI, such as algorithmic bias in college admissions, environmental costs of data centers, or authorship in AI-generated art. These openings were designed to position AI as a public, political, and cultural problem from the outset, anchoring the co-design work in critical AI literacy before design work on the units began. The middle portion of each session combined short conceptual inputs with hands-on co-design work in teacher-student dyads, where each teacher partnered with a student to engage in backward lesson planning, activity design, or assessment design. Sessions closed with whole-group discussion or presentations, surfacing insights and tensions across the dyads and fostering shared reflection on how AI, ethics, and community intersected in their designs.

Sessions 1 and 2 established conceptual foundations: acknowledging different forms of AI literacy, and introducing critical and speculative design [10] as frameworks, with participants drafting learning objectives, outcomes, and assessment ideas. Each teacher entered the program with a vision for how to integrate generative AI tools into their subject area; students and teachers together shaped the terms of that integration, producing a curricular unit in which specific tools would be engaged, questioned, and taught critically. Sessions 3, 4, and 5 are the focus of this paper. Across them, dyads moved from conceptual discussion toward designing

concrete activity sequences, drawing on generative AI tools (including ChatGPT, Claude, and Gemini) and evaluating them for bias in outputs and relevance to their students' community and lives.

3.3 Data Collection and Analysis

We collected four primary sources of data: (1) video and audio recordings of all five PD sessions, (2) co-designed curriculum artifacts produced across the program including activity sequences, unit plans, and design worksheets, (3) pre and post interviews with all six participants, and (4) researcher memos written after each session. We constructed a descriptive case study following Yin [49], as enunciated by Morales-Navarro et al. [34] in the context of CCI research: a detailed description of a phenomenon in context, aimed at depicting how this particular group of participants engaged in PD across a sustained program of work, attending to particulars over causal explanation. The first author coded the video recordings of Sessions 3, 4, and 5, which are the focus of this paper. We organized the video logs using Veldhuis et al.'s [46] four dimensions as an organizing lens, supplemented with co-designed artifacts and interview excerpts.

4 Findings

Three practices of critical AI literacy emerged across the focal co-design sessions, each reflecting a different mode of collective engagement with AI's sociotechnical dimensions. Across all three, what made the practices possible was not only that students and teachers worked together, but that the PD structure made each participant's distinct knowledge necessary. Each dyad inflected these practices through their subject area: the science fiction unit foregrounded sociopolitical futures, and the design unit centered community conditions and justice.

4.1 Collectively Unsettling Assumptions about AI

Each session opened with an ethical icebreaker that brought AI's real consequences into the room before any curriculum design work began, and that lived experience became material participants could design with.

In Session 3, Klaus and León were working on backwards planning for a science fiction unit. As they discussed how to structure students' introduction to AI, Klaus made a design proposal rooted in what the group had just lived through: a series of small structured discussions around the dilemmas described above (e.g., algorithmic bias in college admissions, environmental costs of data centers, or authorship in AI-generated art), what he called 'baby fishbowls,' a structured discussion format in which a small group debates a scenario while others observe, supporting active listening and meaningful participation across the group. Students would grapple with those scenarios and use that as the launch for the entire unit. His reasoning was explicit: "if you didn't know anything about AI, you probably didn't also know that it used up that much water… I think that by having these conversations, they would also learn about all these consequences." The icebreaker format was now something Klaus understood as a pedagogical structure worth encoding into the unit.

León recognized the pedagogical value immediately, noting the fishbowl format "coincides with the stuff admin is pushing right now." Klaus's proposal arrived with a theory drawn from lived experience: students learn to question AI by confronting its real consequences in a structured space for disagreement. That theory was available to Klaus precisely because the participatory design structure asked him to carry two roles simultaneously: student who had just had an assumption unsettled, and designer deciding how to unsettle assumptions for others.

This practice reflects Veldhuis et al.'s [46] dimension of disrupting the commonplace: making strange what students might otherwise take for granted about AI. That disruption emerged through the PD task itself. The backwards planning activity required Klaus to answer what encountering these tools should feel like, and the answer he produced was shaped by having already questioned them: structured confrontation with what AI does and costs, before any unexamined use begins.

4.2 Mutual Learning through Complementary Expertise

The teacher-student dyad structure created conditions in which expertise flowed bidirectionally, a dynamic PD scholars describe as mutual learning [40]. Designing a unit for the teacher's own learning environment through PD meant student knowledge was structurally necessary: the question of what to teach about AI could not be settled without knowing what it meant to be a student encountering AI in this community. What this session shows is that in the context of critical AI literacy, that complementarity is not incidental; the student's community knowledge was what shaped the critical interrogation of AI.

In Session 2, Isa and Violeta were working on a restaurant unit's activity sequence. Isa turned the design question directly to Violeta: "maybe you can help me plan that. How they use a chatbot for the restaurant industry. How would that be used?" She was asking her design partner to contribute knowledge she needed. Violeta's answer functioned as a design argument: "I would imagine, as they use it for customer service. Because you can't really replace a lot of things in the restaurant with AI, because it's all about the people that make it." She proposed specific forms: chat boxes at each station, AI handling dietary adjustments and loyalty programs. The reasoning came from knowing what restaurants in a predominantly Latinx community are and what would be lost if the people in them were displaced. Isa built directly on Violeta's framing and it shaped the activity sequence forward.

This exchange illustrates Veldhuis et al.'s [46] dimensions of considering multiple viewpoints and focusing on the sociopolitical. Isa brought pedagogical expertise; Violeta brought knowledge of what hospitality means in this community. The dyad made both forms necessary, and the unit carried the shape of both. Crucially, Violeta's contributions were constitutive, not supplementary, to the design work. Her positioning as a designer is what gave her knowledge, rooted in questioning what these tools would displace and for whom, the authority to determine how AI would figure in that learning environment and what about it would be taught.

4.3 Grounding AI Critique in Cultural Knowledge and Creative Practice

The third practice emerged from what the design tasks required: that participants name the community conditions surrounding their students' lives. In Session 4, Isa and Violeta worked on a restaurant unit's activity sequence. When the researcher introduced systems thinking as a design frame, Isa invoked a design justice poster on her classroom wall: "who has a seat at the table, and who is your design for? Who is it helping?" This was a design criterion for evaluating what AI would do in that space. She then proposed a pedagogical pivot: after students complete their business plans, she would ask them to redesign for 2035, imagining what AI's role in the restaurant might become. "We have large natural resources, yet large food insecurity," she said, naming the material conditions of the community her students come from and positioning those conditions as the actual design problem. The restaurant had become a scenario rooted in the lived experiences of Isa's students and their community.

In Session 5, León and Klaus presented their unit design. León described asking students to research poverty, healthcare, ecological decline, human rights, and political corruption, then imagine AI futures through those lenses (see Figure 1). Klaus described why the icebreaker structure had to anchor the unit: "the icebreakers both gave us data and information about AI in society, and then at the same time, asked us to use that data and information in our unit." The critical AI literacy developed in the PD sessions was now being deliberately reproduced for students who had not yet sat in those sessions. Klaus's presence across these two vignettes makes a larger arc visible: the student who proposed the fishbowl structure in Session 3 is the same student presenting the finished unit in Session 5. This practice reflects Veldhuis et al.'s [46] dimension of taking action: the interrogation of what AI tools do, whose knowledge they encode, and what they cost was materialized as the content students would encounter.

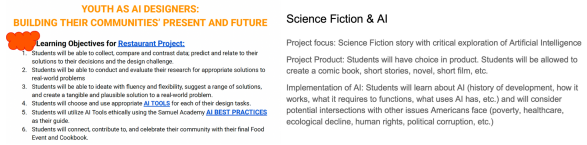

Figure 1: Two co-designed artifacts showing critical AI literacy practices materialized in curriculum. Left: León and Klaus's science fiction unit. Right: Isa and Violeta's restaurant unit.

5 Discussion

This study asked what critical AI literacy practices emerged when high school students and teachers jointly designed how generative AI tools would be used and taught about in their learning environments. What the data shows is that the practices emerged through the PD structure itself. In each case, PD was what enabled youth and educators to develop critical AI literacy together, determining which questions about AI tools were worth asking, what about those tools would become objects of scrutiny, and whose knowledge shaped those answers [8, 15, 31]. Critical AI literacy was simultaneously process and outcome: students and teachers developed it through the very act of deciding how AI tools would be used and taught about.

What this account turns on is a distinction between students as participatory designers and students as informants or consultants. In studies where students contribute knowledge to adult-led design processes, that knowledge is often treated as input to be incorporated or set aside. Here, students' knowledge, forged through critical questioning of what AI tools do and for whom, was constitutive, determining how those tools would figure in their learning environments and what about them was worth learning. That authority was available to them because the PD structure positioned them as designers [20, 30].The dyads in this case sustained collaboration with little observable hierarchy reassertion, a pattern worth examining across contexts. For the CCI community, this reframes participatory design as a site of critical AI literacy practice in its own right [17, 18]. It also contributes to CCI's ongoing work on youth as protagonists [20, 30] by specifying what enabled such positioning in the context of an emergent technology in education: the icebreaker format, the teacher-student dyad, and community-situated tasks each made student knowledge structurally necessary to shape how AI would be used and taught about. Given the small and highly contextualized sample, this case demonstrates what is possible in this setting; future work should examine the sustainability of these practices and how they adapt across different school contexts. This case makes the stakes of those questions concrete, and their answers consequential for how participatory design with youth around generative AI in formal education is practiced.

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Selection and Participation of Children

We recruited students through school and class visits to their teachers' classrooms at a public high school in a city located in southern California, United States. Youth participated in the study in after-school hours. Parents received consent forms prior to the study, which included a brief explanation of the research, and youth provided assent to their participation. All participants received monetary compensation for their time. Research protocols and data collection methods were approved by the Institutional Review Board of the University of California, Irvine.

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