

Cracking the Case, Missing the Data:

Design Tensions in Community-Led Critical Data Literacy Instruction

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ABSTRACT

Critical data literacy is essential for youth navigating a data-driven society, but opportunities to develop these competencies remain unevenly distributed. We present reflections from a community educator-led four-day summer program that introduced youth to data practices through a contextualized detective narrative centered on social media and cybersecurity. The approach deliberately decentered academic authority to honor community expertise. Drawing on field observations and surveys, we highlight a tension in which the contextualized narrative made the curriculum engaging but, at times, obscured the intended data content. We offer design implications for bridging context and content and discuss scaffolds for community-led data literacy programs.

CCS CONCEPTS

- Social and professional topics → Computing education;
- Human-centered computing

KEYWORDS

critical pedagogy, broadening participation, community-centric

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1 Introduction

As data-driven technologies increasingly shape daily life, supporting children to develop critical data literacy is crucial. Critical data literacy extends beyond basic technical skills such as collecting, organizing, and visualizing data; it also involves understanding how data is used to influence decisions, represent communities, and reinforce or challenge systems of power [15]. Developing these competencies is essential for supporting learners to examine and leverage the power of data-driven systems, fostering their growth as responsible digital citizens.

However, opportunities to build critical data literacy are unevenly distributed [11, 14]. Many children, particularly those from historically marginalized or under-resourced communities, have limited access to enrichment experiences that introduce computing and data concepts in meaningful and empowering ways. Informal learning environments, such as community centers and summer programs, offer an important avenue for broadening participation in computing education by providing learning opportunities outside of traditional school structures [5, 8]. At the same time, informal settings present distinct challenges. Learners may arrive with diverse ages, backgrounds, and levels of previous experience, and attendance can fluctuate significantly between sessions. Maintaining engagement is also difficult, particularly during summer programming, when students may have less academic motivation and fewer structured routines. While a growing body of work has explored youth data literacy through playful and participatory methods [2, 4, 16], most of these efforts have been situated in formal classrooms or researcher-led workshops. Less attention has been given to what happens when community educators lead data literacy instruction in their own spaces, using curricula grounded in local youth culture and digital experiences.

In response to these challenges, we partnered with a local community organization to support a four-day summer enrichment program focused on critical data literacy. The program was hosted at a community center in Pittsburgh, United States, and was designed for youth ranging from the fourth to the eighth grade. The sessions introduced core data practices through



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highly contextualized activities centered on social media, cybersecurity, and digital footprints. A key component of the curriculum was a detective-style narrative in which students investigated a fictional hacking case by gathering clues, analyzing evidence, and interpreting data representations. The narrative framing was a pedagogical strategy and an equity-focused choice. By centering topics already meaningful to students' digital lives, the curriculum sought to position their existing knowledge as a legitimate foundation for learning data practices instead of positioning it as an entirely new skill to be learned from scratch. This narrative framing aligns with prior work suggesting that design fiction approaches can support youth engagement and reflection when introducing complex, data-driven technologies [1].

This paper presents an experience report reflecting on the design and facilitation of this program. Importantly, the sessions were led by a community facilitator from the partner organization, while the university-based team served as collaborators and observers. This facilitation model was intentionally chosen to support sustainability and honor the expertise of community educators embedded in the local context. It was also a commitment to decentering academic authority to promote community-centric data literacy. The community educator brought established relationships with local families, contextual knowledge of participants' lives, and experience delivering youth programming that the university-based team, as outsiders, did not share. At the same time, this model raises its own set of questions about how practitioner expertise translates into scaffolded learning experiences and what forms of instructional support are needed when community educators facilitate computing-related curricula.

Across the four days, we observed strong student engagement, particularly when activities aligned with students' lived experiences with social media platforms, online safety, and digital communication. At the same time, we identified a key tension where the narrative context that successfully supported participation and excitement also sometimes obscured the intended learning goals related to data practices. Students could reason through the mystery using their existing digital expertise, social knowledge, and moral reasoning without needing to reflect on data collection, analysis, and interpretation processes. Students were deeply invested in the activities, but their engagement was directed so much toward the investigative context that it reduced the prominence of the targeted data literacy practices.

By documenting and reflecting on this program, we contribute practical insights for educators and researchers designing informal, community-centric data literacy curricula. We highlight three key lessons from this experience: (1) students' prior digital experiences strongly shaped their understanding of data and their engagement with the activities; (2) contextual narratives can be a powerful tool for inclusion and motivation, but may also cloud data learning objectives without intentional scaffolding; and (3) variability in attendance and learner backgrounds requires flexible instructional structures that support the plurality of informal learning communities. These lessons illustrate how informal, culturally grounded learning environments can foster

strong youth engagement with data while also revealing challenges about the relationship between contextual relevance and conceptual transfer.

2 Background and Motivation

This experience report is situated at the intersection of three lines of prior work around efforts to promote critical data literacy among youth, narrative and context-driven approaches to computing education, and community-led models for informal learning.

2.1 Youth Data Literacy as a Critical Civic Skill

A growing body of scholarship recognizes that data literacy is more than a technical skill. It is a civic competency that includes understanding how data-driven systems shape decisions, influence representation, and distribute power [7, 15]. For young learners, these perspectives are increasingly urgent as algorithmic systems become embedded in social media platforms, recommendation engines, and digital communication tools [6, 13]. Robertson and Tisdall [15] argue that youth need both the analytical skills to work with data and the critical awareness to interrogate how data is used in society. Livingstone et al. [12] further note that children already navigate complex privacy and security trade-offs in their everyday technology use, often without adequate support for understanding the data practices underlying those decisions.

Several approaches have sought to make data literacy accessible to young learners through participatory and playful methods. Bae et al. [2] developed visualization toolkits that allow children to create their own data representations using everyday materials. Verhaert et al. [16] designed a life-size physicalization game to engage children with critical data concepts through embodied play. More broadly, Bilstrup et al. [4] proposed design principles for supporting critical data literacy in K-9 education, highlighting the importance of student agency and active exploration of how data is generated, interpreted, and used. These efforts demonstrate that youth can engage meaningfully with data concepts when instruction draws on familiar contexts and hands-on methods. However, as Bae et al. [2] observe, most existing work in youth data literacy relies on formal educational contexts or researcher-led facilitation, which can limit children's ability to explore data topics they find personally meaningful.

2.2 Narrative Framing and Contextual Learning

Narrative and context-driven approaches offer a promising strategy for making data literacy instruction engaging in informal settings where learners' motivations and prior experiences vary widely. Design fiction methods, for instance, have been used to introduce adolescents to machine learning concepts in ways that support both engagement and critical reflection [1]. By grounding learning in familiar scenarios, narrative approaches can lower barriers to participation and create shared entry points for discussion across diverse groups of learners.

At the same time, contextualized instruction introduces a pedagogical trade-off that has received limited attention in the

youth data literacy literature. When learning activities are embedded in compelling narratives, learners may focus on storyline interpretation and moral reasoning rather than on the analytical practices the curriculum is designed to prioritize. This risk may be especially pronounced when the chosen context aligns closely with learners' existing expertise, as the familiarity that supports engagement can also provide a complete interpretive framework that does not require new analytical tool.

2.3 Community-Led Facilitation

A distinguishing feature of this program is that instruction was led by a community educator rather than by university-based researchers. This model reflects a growing recognition that equity-oriented computing education benefits from partnerships that center community knowledge and sustained programming (e.g., [3, 9, 10]). Community educators bring contextual expertise, established trust with families, and familiarity with participants' lives that outside researchers typically lack. These assets are particularly valuable in informal settings, where engagement depends on relational trust and cultural relevance as much as on instructional design.

Community-led facilitation also raises questions that the computing education literature has not fully addressed. How should curricula be designed to support the community educators? What kinds of scaffolds help community educators make targeted practices explicit for novice learners, particularly when their own expertise allows them to navigate data reasoning intuitively? These questions motivate our reflections on the facilitation dynamics observed during the program.

3 Description of Practice

The summer program was a four-day informal learning experience designed to introduce youth to critical data literacy through interactive, context-driven activities. Participants primarily came from families in the neighborhood with limited access to formal enrichment opportunities. The program emerged in response to a community-identified need for affordable summer learning opportunities, particularly around computing-related topics.

The program was facilitated by a community educator who was supported by the partner organization, which already had an established relationship with local families and experience delivering youth programming. The research team supported facilitation during sessions and documented observations.

3.1 Audience and Participants

The program included participants ranging from 4th to 8th graders. Attendance fluctuated throughout the four-day schedule, starting with 13 students and concluding with 16. Because participation was voluntary and shaped by family schedules and availability, some students missed sessions while others joined after the program began. Students entered the program with diverse levels of familiarity with digital platforms, social media, and technology-related risks.

3.2 Program Goals

The program aimed to introduce critical data literacy concepts through engaging, community-relevant contexts. The instructional goals focused on helping students recognize data as evidence, interpret basic data representations, and reflect on how data practices relate to everyday decision-making. The curriculum emphasized topics closely connected to students' lived experiences, such as social media use, online safety, and digital footprints, in order to support engagement and encourage students to view data literacy as personally meaningful and socially relevant.

3.3 Program Design and Activities

The program consisted of four consecutive sessions structured around a scaffolded sequence of activities. Table 1 provides an overview of the four-day program structure, including the primary focus of each session, key activities, and the intended data practices emphasized across the week. Each day revisited prior concepts while extending students' engagement with core data practices, including identifying data sources, collecting evidence, interpreting representations, and synthesizing conclusions.

To maintain engagement and provide a coherent structure across sessions, the curriculum was organized around a detective-style narrative in which students investigated a fictional hacking case. Students were asked to gather clues, analyze information about suspects, and collaboratively determine conclusions based on evidence. Throughout the program, this narrative was used to connect abstract data concepts to familiar digital contexts.

3.4 Outcomes and Documentation Approach

To document the implementation of the program and support reflection on its outcomes, the last author recorded field notes during each session while supporting facilitation as a teaching assistant. These notes captured classroom discussions, student interactions, and moments of engagement, confusion, or unexpected student interpretations. Following each session, the observing author also held a conclusion debrief with the instructor, further enriching the field notes by incorporating the instructor's perspectives on student participation, teaching challenges, and instructional adaptations made in real time. The full research team also reviewed observations collaboratively to identify instructional successes, challenges, and opportunities for improvement in future iterations.

Because the program was hosted as a community enrichment event, no audio or video recordings were collected. To complement field observations, the instructor administered brief pre- and post-program surveys on the first and final day of the program. The survey included both open-ended prompts and Likert-scale questions, varying from -2 (strongly disagree) to 2 (strongly agree), designed to capture students' perceptions of data and its relevance to their daily lives, their awareness of data's role in broader societal contexts, and their confidence engaging in foundational data practices such as gathering evidence and using data to support explanations.

Day	Focus	Key Activities	Target Data Practices
1	Introducing data through lived experiences	Group discussion on social media and cybersecurity; interviews; interactive detective-style activity	Defining data; recognizing data as evidence; identifying data sources; connecting data to personal experiences
2	Data collection and representation	Detective narrative continued; collecting “clues”; introduction to graphs; analysis of digital traces left by suspects	Collecting and organizing information; interpreting basic data representations; connecting evidence to claims
3	Reinforcing the data cycle through investigation	Scavenger hunt using hidden clues written with hidden-paint pens and paper bills; team-based suspect evaluation; Jeopardy-style recap game	Iterating through the data cycle; interpreting patterns; synthesizing multiple sources of evidence; collaborative reasoning
4	Data cycle synthesis and digital citizenship	Review of the data cycle; discussion of digital literacy topics such as digital footprints and cyberbullying; final suspect selection based on accumulated evidence; creative activity using AI-based tools to express data literacy concepts through rap music	Reviewing and applying the data cycle; synthesizing findings; articulating conclusions; connecting data practices to ethical concerns; communicating insights creatively

Table 1: Overview of the four-day critical data literacy program.

To interpret these materials, we conducted a reflective analysis of field notes and survey responses, focusing on critical incidents that revealed moments of learning, engagement, or misalignment between intended learning outcomes and students’ takeaways. Survey responses were used to triangulate classroom observations and to identify patterns in students’ reported perceptions before and after the program.

4 Positionality Statement

The author team brings diverse identities and roles that shaped both the design and interpretation of this program. The first author is a South American woman and a PhD student. The second and third authors are undergraduate students and identify as a woman and a man, both of Asian ancestry. The last author is a South Asian man and a faculty member at the same institution. Several members of the research team bring lived experiences as immigrants and first-generation college students, which inform our commitments to equity-focused computing education and our attention to how students’ everyday digital experiences shape learning.

The fourth author is a Black American woman and community educator affiliated with the partner organization, with established relationships with local families and youth participants. Unlike the university-based authors, this author brought contextual knowledge of the community and served as the primary facilitator of the summer program.

As university-based researchers, we recognize that our interpretations of student engagement and learning are shaped by our positionality as outsiders to the local community. Field notes were recorded by the last author, an academic, whose attention was oriented by academic training in computing education research. The instructor debriefs provided a partial corrective, surfacing moments and interpretations the observing researcher had not prioritized. However, the analytical framework used to organize and present findings in this paper remains primarily

shaped by the university-based authors’ disciplinary commitments. We return to the implications of this dynamic in Section 7.4.

5 Limitations and Assumptions

This experience report has several limitations that should inform how its findings are interpreted. First, the program was short in duration, spanning only four sessions. While this format supported accessibility and feasibility in a community center setting, it limited opportunities for repeated practice, long-term skill development, and sustained reinforcement of core data literacy concepts. As a result, observed outcomes should be interpreted as initial engagement and emerging understanding rather than stable learning gains.

Second, attendance fluctuated across days, with students joining after the first session and others missing sessions intermittently. This variability required the instructor to frequently recap content and adjust pacing, and it likely contributed to uneven learning experiences across participants. These dynamics reflect a common reality in informal learning contexts but complicate the interpretation of students’ learning trajectories and the consistency of program delivery.

Third, the data sources used for reflection were limited. Field notes and instructor debriefs captured rich classroom interactions, but no audio or video recordings were collected, and we did not conduct formal interviews with students, caregivers, or the instructor. Observations may not fully represent all student contributions, and our interpretation of engagement and learning may be influenced by the perspectives of the observers and facilitator.

Fourth, the pre- and post-program surveys were designed as a lightweight tool for capturing student perceptions rather than as a validated assessment instrument. There were a small number of participants who completed both the pre- and post-surveys. Thus, survey findings should be read as descriptive indicators of student

attitudes, and not as evidence of statistically meaningful changes. Besides, even though the facilitator clarified to the students that there were no correct answers to the surveys, there is still potential bias in their responses.

Fifth, this experience report reflects the context of a single community center and a specific set of learners, instructional constraints, and community needs. The curriculum design was grounded in local youth interests, and while this contextual grounding supported engagement, it also means that findings may not generalize to other communities or settings without adaptation. The program also assumed that connecting data literacy instruction to familiar digital contexts would support engagement and that students would be able to transfer insights from the detective narrative to broader data practices. Our observations suggest that these assumptions were partially supported, but that the relationship between contextual engagement and conceptual transfer requires more intentional scaffolding than the initial design provided.

6 Reflections and Lessons Learned

The reflections presented in this section are grounded in field notes recorded during each session, post-session debrief conversations with the instructor, and students' pre- and post-program survey responses. Using these materials, we identified recurring moments of engagement, confusion, and sensemaking. The patterns below illustrate both the advantages and trade-offs of using narrative, context-driven activities to support critical data literacy in an informal learning environment.

Across the four-day program, we observed consistently high levels of student engagement and participation, particularly during activities grounded in familiar digital contexts such as social media, online communication, and cybersecurity. At the same time, we identified tensions between contextual engagement and the development of transferable data practices. In this section, we reflect on key lessons from implementation, focusing on how students' lived experiences shaped their interpretations of data, how narrative framing influenced participation, and how informal learning conditions affected curriculum delivery.

6.1 Students' Digital Experiences Shaped Their Definitions of Data

A central observation from the program was that students entered with strong prior experiences related to the use of technology, particularly through online games and social media platforms. On the first day, when prompted about issues related to social media, many students discussed topics or personal experiences associated with hacking of accounts across different platforms, identity theft, cyberbullying, defamation of character, and the dark web. Some students mentioned direct experiences related to these issues, suggesting that they already held practical awareness of how data manipulation can be used to harm others.

For many participants, the word "data" initially evoked personal associations with devices (e.g., iPhones and computers), internet access, or privacy concerns rather than formal representations such as graphs or datasets. When prompted to

define data on the first day, students offered responses such as "data as in coding" and "there are thousands and thousands of data", reflecting an informal but emerging understanding of the term. Students were also able to articulate foundational ideas when asked directly, offering definitions such as "information we collect" and emphasizing that data can be used "to help us make decisions." These responses suggest that students held meaningful intuitions about data as something that can be collected, tracked, or used against them, even if they did not initially use formal data literacy terminology.

These prior experiences provided a productive entry point for the program, as they allowed instruction to begin from students' existing concerns rather than from abstract definitions. The curriculum was intentionally designed to build on this foundation by using familiar digital contexts as a bridge into broader conversations about how data can be collected, interpreted, and used to shape decisions.

However, these prior experiences also shaped students' expectations for the curriculum. Students often framed discussions in terms of "good" versus "bad" online behavior or focused on identifying threats rather than reflecting on how data can be systematically interpreted and used to support evidence-based conclusions. This pattern highlights the importance of designing informal data literacy instruction that acknowledges students' lived experiences while also guiding them toward more explicit engagement with core data practices.

6.2 Contextual Narratives Supported Engagement but Reduced Visibility of Data Practices

The detective-style narrative used throughout the program functioned as a strong engagement mechanism. Students were highly motivated by the idea of solving a mystery and frequently expressed excitement when new clues were introduced. The narrative structure also supported participation among students with varying levels of confidence, as the activity emphasized collaborative reasoning and discussion rather than technical correctness. This was particularly valuable in an informal setting with mixed ages and shifting attendance. Students drew explicit connections between the detective narrative and familiar themes from popular culture, referencing television shows such as *Criminal Minds* and *Law and Order*. The use of AI-generated characters, such as Sammy, appeared to make abstract investigative tasks more tangible and accessible.

Students also frequently contributed personal stories about their own experiences with online games and social media platforms, which reinforced the relevance of the program's framing. One student shared, "Someone hacked my Roblox account. They changed my name and character," while another added, "They stole my accounts." These experiences connected directly to program discussions of data breaches and online safety. Students also demonstrated awareness of the limitations of online security tools, with one noting, "Sometimes you see ads of software that protect you [...] literally thousands of free ones online, but those are the ones that hack you." This familiarity with

both the risks and perceived solutions within digital environments provided a foundation for their engagement with the curriculum.

In several moments, the narrative framing encouraged skepticism and information-seeking behaviors aligned with critical inquiry. For example, students spontaneously attempted to gather additional evidence by asking whether any further information was available about a suspect (e.g., “Do you know anything else about Nosh?”), suggesting an emerging desire to triangulate information and strengthen their interpretations. One student practiced information validation directly, stating, “I looked up TikTok and the account is not there. That’s AI-generated.” Students also engaged in speculative reasoning about alternative explanations, such as asking, “What if she hacked her own account to post all that stuff?” and challenged assumptions about trustworthiness, arguing that “You cannot judge someone based on their search history. He is trying to help his sister.” Such moments illustrate students engaging in core data practices, including source verification, triangulation across multiple accounts, and reasoning under uncertainty, even though those practices were not named as such in the curriculum.

At the same time, the narrative emphasis introduced trade-offs. Students often became deeply invested in the storyline itself and prioritized resolving the plot over reflecting on the underlying data practices that the curriculum aimed to highlight. In several moments, students’ questions focused primarily on narrative and legal details rather than on how evidence could be structured or analyzed. For example, students asked questions such as “Why don’t they get a lawyer?” and used the chatbot to interrogate suspects with prompts such as “Did you hack Sammy’s account?” and “What apps did you use on June 1st?” When students were asked to prioritize suspects based on interview responses, discussions often centered on interpreting character motivations rather than on systematic comparison of evidence. The same contextual framing that supported inclusion and engagement sometimes made it difficult for students to recognize which parts of the activity reflected generalizable data reasoning rather than story-specific inference.

6.3 Engagement Often Focused on Social and Ethical Meaning Rather Than Data Practices

A consistent pattern across sessions was that students were most engaged when discussing the social and ethical implications of digital technologies. Conversations frequently shifted toward themes such as cyberbullying, online scams, and privacy violations. In one instance, students described a fictional hacking event as “federal”, emphasizing the seriousness of the offense and its potential consequences. In the same exchange, another student noted that they were not allowed to share that information at their age, suggesting an existing awareness of age-related restrictions and norms around online participation. This framing suggested that students understood digital harm as a significant issue and were eager to discuss responsibility and accountability in online spaces.

These discussions were valuable in supporting critical reflection and connecting data to real-world concerns. However,

they also highlighted the recurring challenge that students’ attention settled on the moral interpretation of events rather than on the analytical steps required to support conclusions with evidence. While the detective narrative encouraged investigation, students sometimes treated evidence as a confirmation of their existing suspicions rather than as material for systematic reasoning. When asked to evaluate suspects, students prioritized personal judgments about character behavior over patterns in the presented data. Discussions about digital footprints centered on fear or distrust of technology rather than on concrete reasoning about what kinds of data are produced, how they are stored, and how they can be interpreted.

This pattern suggests that students were practicing a form of critical reasoning rooted in social and ethical evaluation. However, this reasoning did not consistently extend to the analytical practices the curriculum was designed to teach. The engagement was genuine and substantive, but it operated within interpretive frameworks that students already possessed rather than requiring them to adopt new data reasoning tools.

6.4 Informal Learning Conditions Required Flexible Scaffolding and Repetition

The informal nature of the program shaped both the participation and the instruction pace. Attendance fluctuated over days, and students arrived with varying prior knowledge and differing levels of confidence. These conditions required the instructor to continuously adjust lesson delivery and provide repeated opportunities for recap and re-engagement. In particular, activities needed to remain accessible to students who missed earlier sessions while still providing meaningful progression to students who attended consistently.

These dynamics created challenges in maintaining a coherent instructional arc across four days. While the narrative structure supported continuity, the program also required frequent reintroduction of key concepts, including the data cycle and the role of evidence in reasoning. Informal learning programs may benefit from modular designs where each session functions as a partially self-contained unit while still contributing to broader learning goals.

6.5 Survey Responses Suggested Persistent Tensions Between Engagement and Confidence in Data Storytelling

Pre- and post-program surveys provided additional context for interpreting classroom observations (Figure 1). Nine students completed the pre-survey and 14 completed the post-survey. We included only the 7 students who completed both the pre- and post-survey to avoid skewing results due to incomplete responses. Across most items, students reported relatively high pre-survey ratings, suggesting that many participants entered the program with positive perceptions of data and confidence in its relevance. These attitudes remained relatively stable across the program, with small shifts that should be interpreted cautiously due to the small sample size and the exploratory nature of the survey instrument.

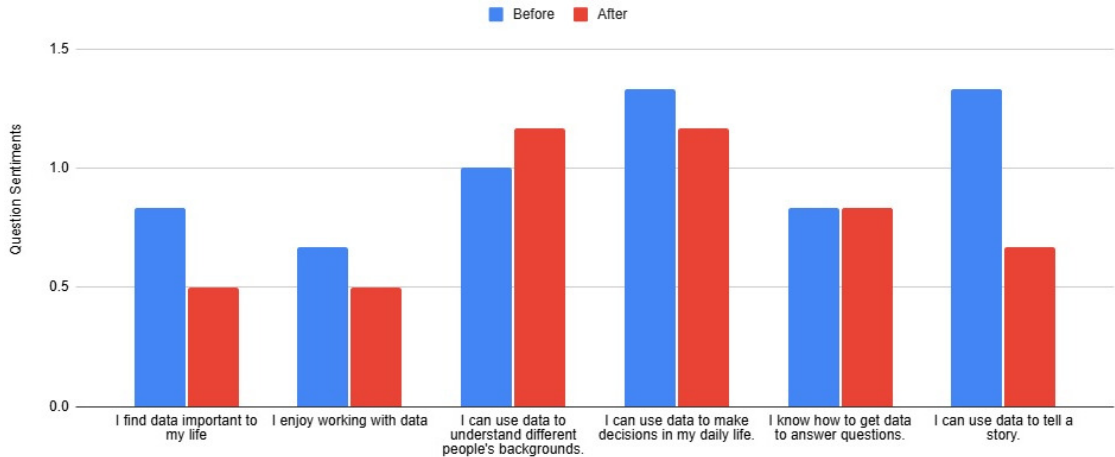


Figure 1: Comparison of average sentiment values for each question from before and after the summer program.

The most notable pattern was a decrease in students’ confidence in using data to tell a story. This aligns with field observations that while students engaged strongly with the narrative investigation, they did not always connect the storyline to the idea of data as a tool for structured communication or storytelling. One possible interpretation is that the program made students more aware of what data storytelling involves, leading some to reassess their initial confidence. Another is that the narrative framing shaped students’ understanding of “story” in ways that diverged from the survey item’s intended meaning. Either reading suggests that engagement-driven contexts may motivate participation without automatically building confidence in transferable data practices.

Students’ open-ended survey responses reinforced this observation. Rather than emphasizing data practices such as collection or analysis, students frequently described lessons in terms of the detective narrative and digital safety, with remarks such as “Do not trust anyone.” These reflections suggest that while the contextual framing effectively captured students’ attention, it also shaped what they perceived as the primary takeaway from the program. Culturally resonant contexts can be powerful entry points into critical data literacy, but they require explicit instructional moves to ensure that engagement translates into transferable data reasoning practices.

7 Implications and Next Steps

This experience report highlights both the promise and complexity of designing community-led critical data literacy instruction in informal learning spaces. The reflections presented here surface a set of design tensions that are likely to recur whenever data literacy, and more broadly, computing education, is grounded in culturally relevant contexts and led by community educators. Below, we outline implications for curriculum design, community partnerships, and the broader field.

7.1 Reflecting on Community-Led Programs

The instruction was led by a community educator. We see this as a valuable pathway to center existing knowledge of the community and expand computing education more generally. But at the same time, we are confronted with the question of how to support community educators in making targeted data practices explicit for novice learners. This is not a deficit in the facilitator’s expertise. It reflects a broader instructional challenge that arises whenever practitioners translate lived and professional experience into teachable practices for novices. Much of the reasoning that supports skilled facilitation, such as distinguishing between narrative plausibility and evidence-based inference, becomes automatic with experience. Making these distinctions visible to students requires a different kind of pedagogical knowledge and instructional support. We believe this is where academics can play a role.

Extending this, we see a need for bidirectional contribution between community and university partners. In our case, the community educator brought relational trust, cultural knowledge, and facilitation skill that made the program possible. The university-based team contributed familiarity with data literacy frameworks and instructional design strategies that could help make implicit practices more explicit. Neither form of expertise is sufficient on its own. Sustained partnerships that value both contributions, and that resist positioning the university as the source of pedagogical authority, are essential for community-centric computing education to grow beyond individual program offerings.

To support this, we are developing the curriculum materials in a Canvas-based format that community educators can reuse, adapt, and extend independently in future offerings. This is one part of a longer-term effort to ensure that the partner organization can deliver data literacy programming on its own terms, drawing on university-developed resources without depending on university presence for implementation.

7.2 Implication: Making Data Practices Visible Within Rich Contexts

Our observations suggest that narrative-driven learning environments can provide an accessible entry point into data literacy. We should provide these contextual engagement opportunities. However, we also should help students recognize the data reasoning they are already doing within those narratives. Throughout the program, students practiced information verification, questioned the reliability of digital sources, weighed competing accounts, and made evidence-informed judgments about suspects. These are data practices, even if students did not name them as such and even if they emerged through narrative interpretation rather than through explicit use of the data cycle framework.

Building on this, we argue that the implication is to build moments into the curriculum where students pause to name and reflect on the analytical work they just engaged in. This is a different kind of scaffold than redirecting students away from the narrative engagement. For example, after group debate about whether a suspect's search history constitutes evidence of guilt, a structured debrief could ask students to identify what data they used, what was missing, and how they weighed conflicting information. Such activities would not interrupt the narrative but would make the underlying data practices visible and transferable. Such instructional moves help learners see the formal practices embedded in the reasoning they are already engaged in instead of presenting data literacy as a separate skill to be layered on top of the context.

We also plan to iterate and explore how to design narrative activities that require explicit data reasoning to resolve. In the current design, students could reach plausible conclusions using social knowledge and moral reasoning alone. Activities where the mystery cannot be solved without constructing a data representation, comparing patterns across sources, or identifying gaps in available evidence would create productive moments where data practices become necessary for narrative progress rather than optional alongside it.

7.3 Supporting Plurality in Data Literacy Education

A foundational commitment of this work is that there is no single correct way to learn data literacy. Data literacy is practiced in different ways, in different contexts, for different purposes. Formal schooling and university-led programs represent one pathway into data literacy. Community-led programs represent another. Neither is a substitute for the other, and neither should be treated as the standard against which the other is measured.

This commitment to plurality matters for how we interpret the tensions described in this report. When students in this program practiced information verification, evaluated the credibility of digital sources, weighed competing narratives, and reasoned about how data can be used to harm or protect people, they were engaged in forms of data literacy rooted in their own digital lives and community contexts. A narrow definition of data literacy focused on the data cycle, graphical representations, and systematic evidence comparison would suggest that these

students fell short. A broader definition that includes critical evaluation of data in context, skepticism toward digital information, and ethical reasoning about data use would suggest that meaningful learning occurred, even if it was not captured by the program's survey instrument or reflected in formal terminology.

We do not posit that ethical reasoning or contextual engagement suffices as data literacy. The ability to collect, organize, represent, and systematically analyze data remains important. But we do argue that our field's definitions and evaluation frameworks need to account for the plurality of settings in which data literacy is developed. When we evaluate these programs solely against criteria derived from formal educational contexts, we risk treating community-based approaches as deficient versions of the "real thing" rather than as legitimate pathways that expand who gets to learn data literacy, how, and on whose terms. We failed in this respect. We are learning. We see that community-led programs like the one described here are distinct modalities that serve particular communities, draw on particular forms of expertise, and cultivate particular kinds of critical engagement with data.

This has implications for research as well as practice. Future work could investigate how to design assessments that recognize both formal data practices and the critical, context-embedded reasoning that community-grounded programs are well-positioned to foster. More fundamentally, research on youth data literacy should examine how different institutional contexts shape what counts as valid learning in the first place. Supporting plurality in data literacy education requires that the computing education community resist collapsing diverse approaches into a single evaluative framework. It requires developing ways of understanding and valuing the distinct contributions that different learning environments and actors in those environments can make.

7.4 Arguing for De-centering Academia While Writing an Academic Paper

We conclude with a tension that we have not resolved. We are making a case for community-led data literacy programs, which, as we have argued, is essential for promoting plurality and de-centering academic authority.

But we also are writing this paper, interpreting classroom interactions through academic lens, deciding which moments constitute "findings," framing contributions in terms of what "the field" needs, and submitting to an academic conference. In some ways, we recenter the very authority we sought to de-center during the program. The analytical categories used in this report (contextual absorption, recognition scaffolds, the relationship between engagement and transferable practices) reflect the university-based authors' training and disciplinary commitments. They are not the terms the community educator would necessarily use to describe what happened in her classroom. We raise this tension because we believe that honest engagement with the limits of decentering is itself part of doing equity-oriented work responsibly.

We have tried to navigate this tension in several ways. The community educator is a co-author on this paper, and findings were shared with her throughout the writing process. Her responses shaped our interpretation of key moments, particularly around what student engagement looked like from her perspective as a facilitator versus what the observing researchers documented in field notes. These exchanges influenced the paper's shift away from deficit-oriented language and toward a framing that treats contextual engagement as substantive rather than as an obstacle to learning. Still, we recognize that co-authorship alone does not constitute shared knowledge production. The community educator's expertise is most fully expressed in the program itself, in the facilitation choices she made in real time, and in her ongoing use of the curriculum with local youth. These contributions are not fully captured by an academic paper, and we resist the implication that they need to be written into an academic format to count as knowledge.

We are exploring ways to make future iterations of this partnership more genuinely collaborative at the level of interpretation and dissemination. This includes developing shared reflection practices during and after program sessions and supporting the community educator in communicating program outcomes to the audiences that matter most to her work, which are the families, community stakeholders, and potential funders. We see this paper as one account of the program, shaped by one set of commitments and constraints. It is not the definitive account, and we hope it is not the only one.

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