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EDITED BY
Janette Michelle Hughes,
Ontario Tech University,
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REVIEWED BY
Rachel Magee,
University of Illinois at Urbana–Champaign,
United States
Hans Christian Arnseth,
University of Oslo,
Norway

*CORRESPONDENCE
Kylie A. Peppler
✉ kpeppler@uci.edu

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"We hear everyday, 'this isn't me.'" Navigating tensions and opportunities to translate interests toward entrepreneurial making

Maggie Dahn[1], Kylie A. Peppler[2]* and Mizuko Ito[1]

[1]Department of Informatics, University of California, Irvine, Irvine, CA, United States, [2]Department of Informatics & School of Education, University of California, Irvine, Irvine, CA, United States

Out-of-school time (OST) makerspaces are spaces for youth to engage in exploratory practices and deepen STEM interests in personally meaningful ways. Many youth—especially teens—additionally benefit from supportive relationships (e.g., caring adult mentors, peer mentors) in these spaces to help them uncover their interests and translate them into long-term trajectories of maker practice. Using a connected learning lens, this paper focuses on supportive adult relationships at a high school OST program (Sunrise of Philadelphia), and the ways in which practices around interest identification and development within its makerspace entrepreneurship program meaningfully impacted learning trajectories for youth by connecting them to new STEM opportunities, knowledge, and experiences. Through an illustrative case study, we present a portrait-of-practice that shows how OST educators facilitated brokering to connect youth to resources, mentoring, materials, and new communities that transcended their specific program. This manuscript contributes to known practices for translating youth interests in makerspaces, including incorporating youth voice and choice and making cultural connections to entrepreneurship opportunities. This case contributes to an understudied area of entrepreneurship education programs and activities that are needed in educational (K-12) makerspaces.

KEYWORDS

maker education, interest, STEM—science technology engineering mathematics, entrepreneurship, connected learning

1. Introduction

Youth interest development is promising for learning in out-of-school time (OST) makerspaces, where youth have more choice over the activities with which they engage than during the school day. However, because there is such a breadth of options for how young people spend their OST and demand for high-quality OST programming is stronger than ever (Afterschool Alliance, 2021), adult program leaders need to develop, capture, and hold

youth interest in ways that extend beyond isolated OST experiences and programs. This imperative is especially important in high school, when young people often have competing responsibilities (e.g., at home, work) and alternative activities that spark their interest (e.g., athletics, music, socializing). What is needed are ways that OST educators can systematically take inventory of and develop youth interests in ways that keep them invested and also impact their future trajectories. This paper is guided by a theory of connected learning (Ito et al., 2013) to illustrate how educators at one high school OST program (Sunrise of Philadelphia) made connections between youth interests and longer term career and entrepreneurship opportunities. Researchers worked with educators at Sunrise to document their practices around interest development within an OST program to better understand how they built relationships with youth and translated their interests to future opportunities. Implications for the design of educational makerspaces include a focus on practices that incorporate youth voice and choice and make cultural connections to develop youth interest in entrepreneurial pursuits.

2. Background

2.1. Connected learning and interest development

Our work is anchored by connected learning, a theory of learning that emphasizes the intersection of youth interests, supportive relationships, and connections to opportunity (Ito et al., 2013). In connected learning, youth interests motivate learners and are leveraged by educators who connect youth to others (e.g., peers, professionals) and opportunities (e.g., internships, summer programs) that can help further develop these interests. Years of connected learning research has illustrated the value of cultivating interest through supportive relationships with adults, peers, and family members to support youth in working toward life opportunities (e.g., future career, academic after-school activities, and other civic or volunteer opportunities). Educators in OST environments can support youth interest signaling, or "actions youth undertake to communicate their needs in ways that motivate adults and peers to mobilize resources to support them" (Ching et al., 2016, 2018, p. 4) in ways that help youth further their existing interests.

Connections across settings is an element of connected learning that emphasizes how learning can be connected across sites for learning and development in ways that support learners in, beyond, and across particular environments. (Ito et al., 2013) name this element and break it down into design principles for making connections that describe different ways in which connections are made. These design principles include (1) coordinating learning across settings such as between school and OST programs, (2) supportive adults brokering learning opportunities across settings, (3) using an openly networked infrastructure, and (4) making learning and achievement visible across settings. These design principles are enacted through practices that educators take up and implement in their routine interactions with youth.

Supportive relationships with OST educators facilitate brokering across settings to connect youth to resources, mentoring, materials, and new communities that "transcend a specific program" (Ito et al., 2013, p. 42). Effective brokering can lead to a number of valuable life outcomes for youth and also increase their social capital (Peppler et al., 2016a,b). In this paper we focus on supportive relationships (e.g., caring adult mentors, peer mentors) that can meaningfully impact learning trajectories for youth by connecting them to new career and entrepreneurial opportunities, knowledge, and experiences. In this case, OST educators built from youths' existing interests to broker connections to opportunities.

2.2. Supporting youth interest in makerspaces

The maker movement has historically emphasized interest development through hands-on production practices to engage learners in STEM, computer science (CS), and other areas like the arts. In particular, researchers have focused on the opportunities for engaging learners in CS activities through the coding of robots, computer programs, e-textiles, and other makerspace staple toolkits (e.g., Sheridan et al., 2014; Peppler et al., 2016a,b; Bevan, 2017). Makerspaces can provide multiple points of entry for historically marginalized youth to engage in STEM through culturally relevant practices (e.g., Honey and Kanter, 2013; Calabrese Barton and Tan, 2018). Less emphasis has been placed on entrepreneurship programs and activities in makerspaces, despite the promise that makerspaces hold for supporting small businesses, new patent development, and innovative new startups (van Holm, 2015, 2021).

Prior research has demonstrated the value of OST writ large in the development of STEM identities (Allen et al., 2019; Shaby and Vedder-Weiss, 2020; Wade-Jaimes et al., 2022). However, OST programs, including makerspaces, often struggle to retain teens, particularly from lower income families, due to the multiple and intersecting pressures around family caretaking responsibilities, ability to earn additional income, and costs of care when adult supervision is no longer needed (van Holm, 2021). van Holm (2015) and van Holm (2021) suggest that OST programming with a focus on entrepreneurship can present possibilities for supporting youth in linking their interests to professional goals for the future or showing entrepreneurial intent (e.g., Engle et al., 2011). Given connected learning's orientation toward connecting youth interest to future opportunity (whether academic, civic, or career), this study closely observes the STEM activities of youth in makerspaces in relation to entrepreneurial orientations, as STEM fields are areas of expanding academic and workforce opportunity in the 21st century. This case illustrates how practitioners can work to identify and extend youth interest and, importantly, connect those interests to future entrepreneurial opportunities through making.

3. Materials and methods

3.1. Research questions and modes of inquiry

Aligned with a connected learning perspective, we pursued the following research question in this work: In what ways do supportive adults build from youth interests to broker future opportunities? This paper focuses on one illustrative case study (Stake, 1995), which we call a *portrait-of-practice* since it illustrates the fine-grained story of practice in a particular context (Siegesmund, 2005; Maloch et al., 2013). In contrast to some other portraits-of-practice found in the literature, a member-checking process was essential to our development, as the interpretations presented went through multiple rounds of revision and feedback with participants. The portrait-of-practice illustrates how educators translated youths' interests toward STEM or other entrepreneurial opportunities. In our results, we focus on telling the story of the program and surfacing specific practices with which OST educators engaged to translate youth interest.

Our data sources included interview transcripts from 1 h-long interview with Sunrise program leaders as a pair, as well as an additional hour-long interview with one on the design of their practices. Interviews were conducted in the Fall and Spring of the 2021–2022 academic year as organizations tried to get back to a sense of normal operations amidst the COVID-19 pandemic. Portraits-of-practice were written based on these conversations. We used open coding (Corbin and Strauss, 2007) with interview transcripts, attending to the ways in which the program leaders discussed youth interest development and described practices they implemented to support interest development and broker connections for youth.

3.2. Participants and context

3.2.1. Sunrise of Philadelphia

Sunrise of Philadelphia (or Sunrise; not a pseudonym) has provided a range of K-12 after school and OST programs for youth for over 20 years. Its high school program at South Philadelphia High School emphasizes the role of "caring adults and academic supports that help youth stay on the path to graduate, while also planning for the future and building the skills needed to succeed" (Sunrise, 2022). Students finish their school day and then come to the room in which Sunrise operates from 2:30–5:30 p.m. or they stop in throughout the day to ask questions or work on projects. Sunrise high-school-aged youth often ask for career or college-related advice, such as trade school options or for support with college essays. More recently, the Sunrise location at South Philadelphia High School used funding to start a small makerspace where youth work. This makerspace startup included getting materials such as a 3-D printer, robotics equipment, screen printing materials, an embroidery and sewing machine, and a heat press, as well as teaching youth how to use them.

3.2.2. Sunrise youth

Brianna (not a pseudonym), the Site Director, reported that because of the nature of the school and neighborhood in which they are located, they serve "Black and Brown" and "primarily low-income families" who "all receive free lunch." We learned from Brianna and the Program Coordinator, Najla (also not a pseudonym), that there are different levels of participation among youth in their program. There are about "96 students enrolled," with "about 75 [they] see at least once a month" and "about 15 [they] see multiple times a week." Brianna said that they admit everyone to the program who applies, but some youth may have difficulty attending on a regular basis because they may be involved in sports and other activities or have home- or work-related responsibilities after school. Strategically, the physical Sunrise of Philadelphia spaces are all located within K-12 schools from which they recruit students so it is easy for students to get to their spaces, as they generally just need to walk down a hallway or up/down a flight of stairs. For example, the students who attend South Philadelphia High School and are part of the Sunrise program come "up or down to the third floor" to Sunrise.

3.2.3. Background on adult program leaders

Brianna works as the Site Director for Sunrise of Philadelphia and has been with the organization for 2 1/2 years [An exceptional leader and advocate for youth, Brianna was also recently named a 2021 PA Afterschool Champion (Lattanzi, 2022)]. Her academic background is in human development and community engagement and she has been working with youth in community-based organizations for about 7 years, beginning with tutoring in high school and eventually getting into leadership development and community organizing. She explained that youth have work release early in the day and often drop by during their work release hours for support. Brianna thinks that being an effective leader and mentor for the youth at Sunrise requires being patient and open-minded, and she explains that she is constantly in communication and conversation with students. Najla had only been with Sunrise of Philadelphia for a few months at the time of our interview, explaining that she was currently pursuing her degree in child and adolescent development and was "trying to learn just as much as she can from Brianna." Najla described working with older youth as "rewarding" and saw her role as focused on helping them make decisions about post-secondary planning, such as going to trade school and supporting their entrepreneurial interests.

4. Results

4.1. Building relationships by creating space for youth voice and choice

Brianna and Najla explained the importance of relationships and youth voice and choice for their programming model. Brianna explained that to recruit students, "most find out through word-of-mouth" by others who participate in the program. Sunrise "posts fliers" around

the school but mostly, "it was a solid group of students" when Brianna started and they just kept coming. She explained, "they'd invite their friends and their friends and their friends, and now, at this point it's like, you come in and you'll see all the different friend groups, and they all do engage with each other, but you can see who's known each other the longest and who's the closest." When asked why students keep coming back to Sunrise, in addition to seeing their friends, Brianna explained:

> "*We have very close relationships with a lot of the kids.* They feel comfortable during the day if they have any issues …there's been times where there's kids waiting outside of our office because *they're having a bad morning, and they want to talk to someone, but they only want to talk to us.* Even on weekends and evenings sometimes after we leave we will have kids texting our Google voice number like checking in and asking questions or letting us know they need to talk to us when they come back to school."

The cultivation of these supportive relationships—as evidenced by students contacting Brianna and Najla at all hours and coming to them for a wide range of reasons, both program related and not––comes into more vivid detail through how Brianna described their programming model and the values around which they design the work they do with youth. When asked explain why they thought they were able to create such tight bonds with youth through their program, Brianna explained:

> "*I think youth voice is important so we give the students a choice as to what they do.* So, of course we come up with plans, but if we notice that they're not engaged, we'll ask them, 'alright, y'all don't want to do this so what can we do different?' You know we [also] have to cover certain things [like homework help] so I maybe explain 'we know you guys don't want to do too much math and reading and science-type stuff but unfortunately we have to do that so if we have to do it, how can we do it in ways that you are actually going to participate?' And I think giving them that choice made it easier for us to plan on our end."

This concerted attention to youth voice and choice even within particular requirements or parameters out of their control (e.g., completing homework), is part of what sets the Sunrise OST space apart from the school space and helps cultivate close relationships between the OST educators and youth. Brianna's quote above illustrates how even when youth "have to" do their "math and reading and science" homework, that they go to youth to ask them how they can do it and navigate this tension by finding a different entrypoint to the activity. Attending to youth voice and choice throughout the program, even when an activity does not seem to start with it, is important for Brianna and Najla in designing their space and helps to intentionally build relationships with youth.

4.2. Using cultural connections to channel youth interests toward STEM

Drawing from the trusting relationships established with youth, Brianna and Najla further described their intentional approach to integrating youth voice and choice in their STEM programming and entrepreneurship program by making cultural connections to youth interests. Though Brianna does not have a background in science ("I actually used to hate it"), she helps to broker STEM opportunities for the youth with whom she works by matching their interests with specific resources and opportunities to which she is connected.

Brianna explained how cultural connections could lead to youth developing interests in areas they might otherwise overlook. In short, the move to curate a makerspace as part of the Sunrise program was motivated by Brianna noticing youths' interests in entrepreneurial pursuits but finding "that a lot of kids do not know how to talk about the kind of work they want to do." They may express a more general interest in "clothing brands" or the "music industry" but aren't quite sure how to cultivate or channel those interests in tangible ways. These facilitation moves are about starting with youth interests (e.g., an expressed interest in fashion or music) and connecting those interests to a STEM-related activity (e.g., using high and low-tech tools to create something in a maker space). By building on and connecting to youth culture and what youth already care about, as well as brokering potential new opportunities, Brianna and Najla showed how youth interests and culture can be translated and leveraged toward STEM learning.

4.3. Translating youth interests to broker entrepreneurship opportunities

Important to their work with youth was not only helping youth believe they could pursue a STEM interest but also that they might consider how that interest could lead to entrepreneurial pursuits (e.g., how to market a product created in the makerspace). Brianna explained that the entrepreneurship focus within the Sunrise program encouraged a lot of kids to participate because they wanted access to the resources the makerspace provided and they were driven by the idea of making physical things directly connected to their interests.

Though not fully realized as of our interview, as part of their long-term goals for the entrepreneurship aspect of their program, they discussed the hope to market and sell items students created such as "selling t-shirts, buttons, or setting up a pop-up shop…we talked to partners about creating an exhibition in our room." Brianna explained that an indicator of success would be to see students produce physical products of their ideas. Brianna detailed the plan for this longer term vision:

> "This year I feel like a few students may get one physical piece that has their own logo or design, whereas in five years my hope would be to actually help students start their own

> business, maybe to actually produce a song, their own beat that they can sell, something along those lines, *like giving them a tangible piece of something that they can actually make an income off of*."

Brianna and Najla emphasized the value of making things tangible and real, something their students could make with their hands and show to other people, and potentially even market as part of developing a small business. For Brianna and Najla, these experiences creating artifacts could be the thing that makes the difference for youth in connecting their interests to real-life opportunities.

4.4. Effective tools for identifying and cultivating interests

From the start of the program through its duration, interest development is at the heart of the Sunrise approach. Brianna described her passion as "helping youth tap into their interests and break barriers." She also described an interest survey they gave youth (which originated with the Philadelphia Youth Network), noting that they "try to take those seriously" and then use their responses to make purposeful connections with partners for youth. The survey asks youth to reflect on how they learn, their goals, future career interests, and interest in social issues. Youth interest development is baked into the infrastructure of the program––the Philadelphia Youth Network provides Sunrise with funding for an incentive system as each young person can earn up to $595/year for completing different benchmarks such as filling out interest and career surveys.

Brianna and Najla acknowledge how difficult it can be for one of their students to commit to developing an interest. Brianna said, "*We hear it everyday, 'I do not want to do this, this is not me, I do not like this.*'" The OST educators talked about meeting this expected resistance with helping students find multiple points of entry for participation. For example, they engaged in a project with local mural artists and found ways for all students (even those less artistically inclined) to find an interest-driven pathway into the activity. Najla explained that by finding new entry points:

> "The resistance is subsiding, and they're becoming more interested and approaching each project from their own little vibe. For example, one student is very interested in graphic design so instead of painting he did this whole Photoshop portrait, and it was really cool, and it's exciting to see them break the barriers they have with these things that make them uncomfortable with these things."

Because Brianna and Najla created a space for each Sunrise youth to "bring their own little vibe" to their work together, youth found new ways of working and discovered new learning opportunities available to them based on their interests.

5. Discussion

Connected learning examines the nature of supportive relationships in the translation of youth interests to future opportunity. In this way, connected learning is both a theory of learning as well as a pedagogical approach that emphasizes social connection, builds youth identities, and elevates their voices within broader networks and communities of practice. Results presented in this manuscript advance our understanding of connected learning by contributing to (a) known principles and effective pedagogies for identifying and developing interests, particularly among teens, in makerspaces and (b) the understudied area of entrepreneurship education programs and activities that are needed in educational (K-12) makerspaces. This study showed how OST educators in a makerspace environment identified, developed, and translated youth interests toward STEM learning and entrepreneurship opportunities by incorporating youth voice and choice into programming, making cultural connections to youth interests, and brokering interests toward entrepreneurship opportunities. This study surfaced these effective practices and tools for supporting their implementation in OST spaces such as using youth interest surveys, finding ways to financially incentivize youth, and connecting them to makerspace tools and resources needed to further their interests (e.g., access to Adobe Photoshop, 3-D printers). The significance of this work is that it highlights effective practices for understanding how OST educators in makerspaces environments can effectively broker new STEM and entrepreneurship opportunities in efforts to create more equitable opportunity structures and culturally connected learning for youth.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author/s.

Ethics statement

The studies involving human participants were reviewed and approved by the University of California, Irvine's Institutional Review Board (IRB). The participants provided their informed consent to participate in this study. Informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

The grant was awarded to KP and MI. Data collection, analysis, and writing were done jointly by MD, KP, and MI. MD drove the writing and conceptualization of the initial case study

captured in this report. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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