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"I learned a lot about me as a person": University students' development as non-formal education professionals

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Introduction: The role of non-formal educational professionals has implications for the growth and development of the children they interact with. This group of professionals includes university students who volunteer their time in educational and youth-service organizations.

Methods: In this collective case study, we utilized Cultural-Historical Activity Theory to (a) understand how undergraduate and graduate students negotiated their development as a non-formal educational professional within an afterschool program and (b) consider how contradictions influenced their growth as educators, if at all. Three forms of data were collected from 10 graduate and undergraduate students as they volunteered their time as an educator in a 10-week afterschool program in partnership with two rural middle schools.

Results: Results highlighted shared contradictions among university students, such as lack of content knowledge and being viewed as friend versus being viewed as an educator, as they individually and collectively reflected upon their development and growth as non-formal educators within the afterschool program. Results also underscored how being a part of the afterschool program and reflecting on practice supported only some of the university students' initial goal(s) for volunteering their time.

Discussion: We conclude with implications of this study for universities to consider in supporting the professional growth and development of their students as active learners and future educational professionals.

KEYWORDS

on-the-job experience, professional development, non-formal learning environment, reflecting on practice, university students

1 Introduction

Experiences in non-formal learning environments (e.g., before- and after-school programs, museum camps, library workshops) are common opportunities provided for children and adolescents in the United States (U.S.; Afterschool Alliance, 2020). While educators in non-formal learning environments[1] are key to the growth and development of

1 In this study, non-formal refers to learning environments that are structured and facilitated by educators to promote learning, but learning is not evaluated (Eshach, 2007). This contrasts formal environments that are compulsory, defined by standards, and possibly repressive. Although, many of our participants used "informal" in their language, this was used synonymous with non-formal.

children and adolescents, research has shown how educators are often poorly supported through short, top-down provided trainings (Allen and Crowley, 2017; Tran et al., 2019), tend to rely on conceptualizations of knowledge and pedagogy familiar to them through their own experiences of learning in a school-based environment (Bevan and Xanthoudaki, 2008; Hwang et al., 2020; Lachapelle et al., 2019), do not feel prepared to support children's understanding of particular concepts, engage with a diverse population (e.g., special needs, intergenerational groups), and facilitate an enjoyable learning experience grounded in pedagogical practices (Ennes et al., 2020; Rose et al., 2019). We hypothesize that this includes university students in which about 22.6% of this population engaged in formal volunteering opportunities in 2023 (AmeriCorps, n.d.), such as educational and youth serving organizations.

To address this issue, we utilized an approach of learning-on-the-job, more specifically an active learning approach within a community-engaged university course (Sanford and Sokol, 2017) that included reflecting on the teaching and learning process. Reflective practice is grounded in the seminal work of Dewey (1938) theory of inquiry and Schön (1983) theory regarding reflecting in action and reflecting on action, as well as many others. Finlayson (2015) described reflective practice as a "dynamic definition that is open to personal interpretation to suit the individual undertaking reflective practice" (p. 723). In this study, participants reflected on action by looking back on their experiences in the afterschool program through reflective writing prompts and discussions. Research highlights how reflective practice supports individuals in analyzing and modifying their practice (including counteracting or resisting dominant practices), shifting beliefs and attitudes, increasing autonomy and agency, cultivating and internalizing new knowledge and skills, and developing empathetic relationships (Ash and Clayton, 2004; Georgii-Hemming et al., 2020; Van Beveren et al., 2018).

Situated within an afterschool program designed to enhance middle school learners' understanding of science and mathematics through archeological concepts and local Indigenous cultures, we sought to (a) understand how undergraduate and graduate students negotiated their development as educators within an afterschool program and (b) consider how contradictions, defined as historically evolving tensions (Engeström and Sannino, 2010), influenced their growth as educators. We agree with Vandell and Lao (2016) that higher education plays a critical role in creating a pipeline of non-formal education professionals. Through this study, we argue that feelings of uncertainty and dissonance as experienced by university students as educators are acceptable forms of professional development and professional growth. As noted in the following quote, Maxine believed her development and growth as an educator were shaped by uncertainty and the unknown.

> …because I feel like without that period of where I had to figure out things for myself and figure out a way to gain confidence in myself by myself, I feel like it would not have been the same if I knew everything or if I had any more knowledge on how things were going to go [beforehand].

As such, the significance lies in the role of the university in developing the professional and personal growth of university students as educators. Further, this has implications for the growth and development of the children they interact with (Maiorca et al., 2021; McGuire et al., 2022). For example, research consistently provides evidence that high-quality afterschool programs increase academic and socio-emotional outcomes for children (Vandell and Lao, 2016).

2 Theoretical grounding

This study is grounded in cultural-historical activity theory (CHAT), which Ash and Kelly (2013) noted as being a theory rarely utilized in non-formal learning environments, particularly studies that aim to understand the professional growth and experiences of educators in non-formal contexts. CHAT is a sociocultural theory that conceptualizes individuals and their environments as a complex unit of analysis (i.e., an activity) grounded and shaped within local, cultural, and historical contexts (Engeström, 1999). For example, Pearson (2009) examined shifts in prospective teachers' conceptualization of association between the terms disability and special education through various factors and experiences (e.g., coursework, school placements). While this study was situated within a local context, it was further grounded in broader historical understandings and meanings of the words, special education and disability, in society and education. As such, CHAT has been applied within a range of educational contexts and human activities such as teachers' understanding of teaching and learning principles of making and tinkering within their local school context (Heredia and Tan, 2021), professional development opportunities for K-12 teachers (Yamagata-Lynch and Haudenschild, 2009), and a prospective teacher's student teaching experience in urban high-needs schools (Anderson and Stillman, 2013). Figure 1, which was originally developed by Engeström (1987), illustrates the complexity of an activity system and the six components that compose and mediate the relationship between subject and object.

The subject refers to the individual or group whose perspective is the focus of analysis. In this study, the subject is the individual participants. The object refers to the goal or purpose that drives the subject's activity. In this study, the specific object is the reason participants chose to be a part of the afterschool program. The object turns into outcomes through other components (i.e., mediating factors, such as tools, refer to physical, mental, or semiotic representation; Engeström and Sannino, 2010). The community is composed of other individuals and/or groups that share the same object as the subject. In this study, this may be other university students, afterschool educators, middle school learners, and/or parents. Rules refer to the implicit and explicit norms and expectations that shape and constrain the actions and behaviors of the subject. Lastly, division of labor refers to vertical (e.g., adult-child) and horizontal divisions (e.g., student- student) of power and status. Figure 2 is an illustration of an activity system specific to this study. The arrows indicate contradictions within a component (i.e., tools) and between two components (e.g., rules/norms–tools).

The six components of the activity system are not isolated or static, but as implied by the arrows in Figure 1, the components mediate and shape each other. The dynamic nature of an activity gives rise to contradictions and leads to expansive transformation and change (Engeström, 1999). More specifically, transformation in an activity system involves how the subject modifies the object through the various components. As an example, Jocius et al. (2020)

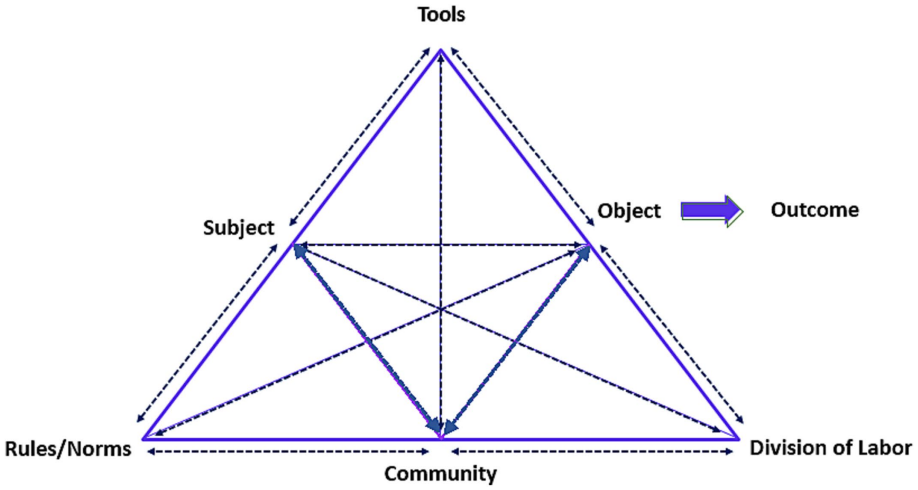

FIGURE 1
General model of an activity system (Engeström 1987).

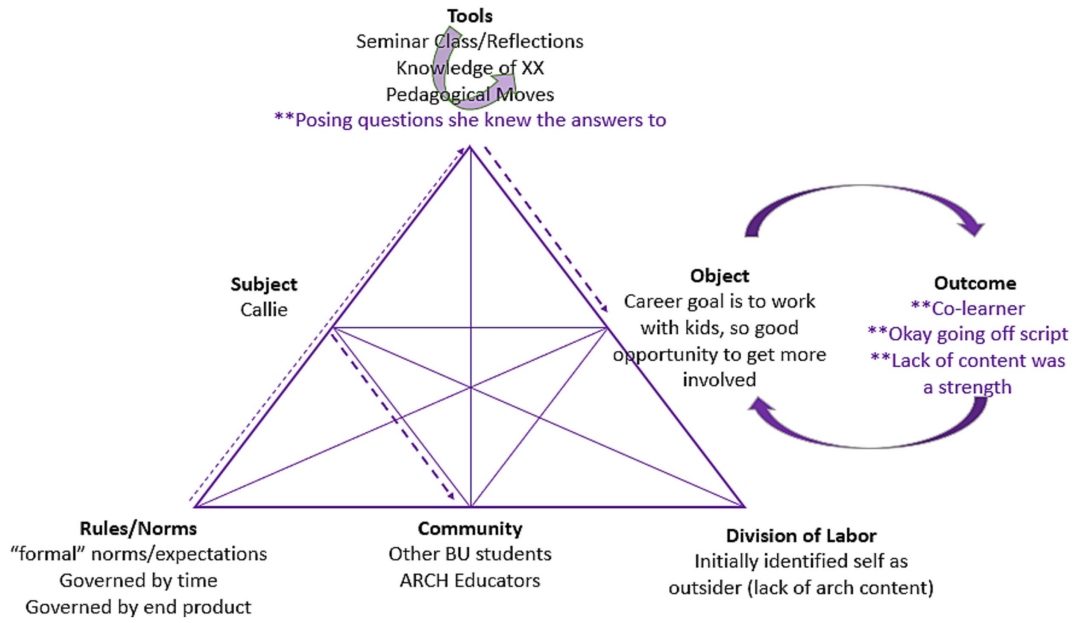

FIGURE 2
Activity system example from Callie, a participant in this study.

highlighted the contradictions (e.g., failure vs. completion, chaos vs. control) that teachers experienced when implementing maker-based kits into their classrooms, but also how integrating the kits transformed teachers' perspectives of how to address state standards through the use of the kits. In the context of this study, transformation and change is examined within a university student's development as a non-formal educator. This is aligned with Engeström and Sannino (2010) expansive learning as boundary crossing as university students bridged the gap between formal and non-formal learning environments, and between their role as educator and role as student. Similar to Ash and Kelly (2013), we do not contend that expansive transformation may occur within the professional development experience discussed in this paper, but that there is potential to plant a seed for expansive transformation as participants continue their growth as educators in other non-formal learning contexts.

3 Methods

In this study, we employed a collective instrumental case study with each case representing a university student (Stake, 1995). An instrumental case study afforded researchers an opportunity to gain insights into university students' personal growth or lack of growth as non- formal educators through an afterschool program for middle school learners. Further, this approach allowed us to analyze each case

or university student individually to then collectively look for patterns across all university students.

3.1 Context and participants

This study was situated within an afterschool program designed by the fourth author to develop and support middle school learners' understanding of and engagement in science, technology, engineering, and mathematics (STEM) concepts, processes, and skills through archeological concepts, as well as Indigenous people's respect for the environment and all its ecological components (Sanford and Sokol, 2017; Simpson et al., 2023). The focus of the program was on the precontact history of the Northeastern region of the United States because of the opportunity for educators to make connections to students' experiences (e.g., fishing and hunting) and local environments (e.g., rivers and archeological sites).[2] As implemented, the program aligned with norms and principles of formal learning environments such as raise your hand to speak, initiation-response-feedback interactional patterns, and passively listening to information being provided. It was further aligned with the norms and expectations of non-formal learning environments such as active participation, lack of assessments, and learner-centered approaches (Bevan and Xanthoudaki, 2008; Eshach, 2007; Rogoff et al., 2016). As described by Simpson and Feyerabend (2022) and Simpson et al. (2023), the program can be considered a third space, a space in which norms and expectations of formal and non-formal learning environments converge.

The program occurred during the Spring 2021 and Fall 2021 semesters within two local rural school districts each semester (i.e., two programs in Spring 2021 and two programs in Fall 2021). The program spanned 10 weeks, meeting twice a week for 1–1.5 h in one rural school district and once a week for 2 h in another rural school district. Within the afterschool program, university students were active educators in that within each of the various activities, they engaged with middle school learners both individually and in small groups. They were expected to support the middle school learners' development of STEM concepts by posing questions, providing guidance, and facilitating collaboration. In Spring 2021, the first author facilitated a seminar course that focused on supporting university students' development as non-formal educators. Topics included how to support middle school learners with a disability, how to foster STEM practices, ways to facilitate small group interactions, and questioning techniques and talk moves. In addition, they often came prepared to discuss positive and negative observations and questions situated within their experiences (e.g., what instructional move should I make in this case). We met virtually once a week during the semester for a 1.5-h period. In Fall 2021, we shifted the seminar to occur immediately following the afterschool program. We reflected upon their experiences, highlighted things that went well, and discussed opportunities to make a change in their approach(es) as non-formal educators. Despite the differences in approach, these experiences informed their development and reflections as non-formal educators. This is similar to the argument that our experiences, social interactions, and cultural norms inform individual's identity development as a dynamic process (Kim et al., 2018).

The participants that informed the results of this case study included 10 graduate and undergraduate students at a university located in the Northeast region of the U.S. Consent was obtained from all individual participants prior to beginning the study. Table 1 includes self-identified and self-reported information from each participant. As noted in the table, participants had a range of experiences from no experience working with children to experiences in formal and/or non-formal learning environments, as well as differences in their major. As part of the afterschool program, they spent between 20 and 25 h engaging with middle school learners.

3.2 Data sources

To address the research question, we collected data regarding university students' experiences through three data sources: weekly written reflections, video and/or audio recordings from the seminar course, and a post-interview.

3.2.1 Written reflections

University students submitted reflections questions developed by the first author each week they were able to attend the afterschool program. They reflected upon a standard set of questions, but there were also questions that changed each week based on prior conversations in the seminar course. Sample questions included (a) What went [did not go] well? Why? Provide evidence. Focus on your role as a non-formal educator and your interactions with the students; (b) How did you support students as STEM learners this week? Provide specific examples to support; (c) For the letters (F, S, A, D, P, M, E, Y, K), pick three to write a word and/or phrase that captures things about you as a non-formal educator and/or the environment/program in general. As an example, for the letter K, I might say Kindness. Then for each, explain and include examples to support.

3.2.2 Video and audio seminar recordings

In the Spring 2021 semester, video recordings of the virtual seminar were collected. Recordings occurred at the start of the seminar when university students shared and inquired about their experiences as a non-formal educator in the afterschool program during the week. We collected eight videos that ranged between 14:17 to 26:33 (minutes:seconds). In the Fall 2021 semester, audio recordings of the post-afterschool program reflections were collected. This included 14 audio recordings that ranged between 8:29 to 16:02 in length across both middle school sites.

3.2.3 Post interviews

Semi-structured interviews were conducted by the second or third author at the conclusion of each 10-week afterschool program. The interviews were conducted via Zoom and lasted approximately 30 min in length. The purpose of the interviews was for university students to reflect upon their entire experience, ways in which they grew through the program (or not), as well as how the program supported their future goals/plans. Questions included (a) If you could sum up your experience this semester with an image, what would it be? Take a few minutes to find the image, and then we will share and discuss; (b) How

2 Refer to the following website description of topics: https://archaeolessons.com/.

TABLE 1 Participant information.

Pseudonym	Degree/Major	Gender identity	Ethnic identity	Previous experience with children
Adina	Undergraduate/ Anthropology	Cisgender	Asian American	Served as camp counselor for kids ages 5 to 11 years old for 5 years. Taught K-2 children at religious school.
Allison	Undergraduate/ Mathematics	Female	White	Supported students between ages 3–6 with a variety of disabilities. Served as a high school classroom assistant for one semester.
Amelia	Undergraduate/ Anthropology	Genderqueer	Latino	Tutored elementary students during high school
April	Undergraduate/ Mathematics	Female	White Hispanic, first generation Greek and Colombian	Served as a camp counselor. Worked at a before and afterschool program for elementary schools. Served as a middle school classroom assistant for one semester.
Callie	Undergraduate/ Psychology	Female	White	Served as a camp counselor for 3 years and a teacher's assistant in a summer art program. Tutored during high school.
Karri	Graduate/ Anthropology	Queer	White, Non-Hispanic	Semester of student teaching. Served as classroom assistant in Italian high school. Worked at an archeology site at a public museum.
Kristy	Graduate/ Anthropology	Female	White	No prior experience.
Mandy	Graduate/ Biomedical Anthropology	Female	White	No prior experience.
Maxine	Undergraduate/ Anthropology	Female	White	Served as a swim instructor.
Rosalyn	Undergraduate/ Biochemistry	Female	African-American of Latin descent	No prior experience.

would you define a non-formal educator? In what ways do you see yourself as a non-formal educator? Provide specific examples; (c) How have you grown in your role as a non-formal educator throughout the program, if at all; and (d) What do you feel you have gained from this program professionally?

3.3 Data analysis

The analysis began by pasting direct quotations from participants from each data source into an Excel sheet by week in the afterschool program. Next, two members of the research team added analytical memos for each week. Analytical memos were employed to extract meaning from the direct quotations as situated within the afterschool program (Birks et al., 2008). We aimed to answer the following question, "What is actually happening in the data?" (Glaser, 1978, p. 57) when writing our analytical memos. As such, our observations of the afterschool program supplemented and informed the meaning we unearthed and articulated through the memoing process. Yet, memoing afforded us the opportunity to record our thoughts and ideas without fear of making an erroneous coding decision and to explore relationships within and across university students to achieve a level of abstraction from the data (Birks et al., 2008). In addition, we employed investigator triangulation as these analytical memos were generated from two individuals with different backgrounds and experiences (Denzin, 1984). As an example, the following is a direct quotation from Mandy, followed by analytical memos from two members of the research team.

> *Mandy*: On one hand, like it is nice to know that they [middle school learners] feel comfortable enough with me to be like sharing those things. But on the other hand, I'm like I do not care enough. Like I do not need to know your dating life. So there was definitely to that point where you had to be really careful about crossing that line. Like you want to be a non-formal educator, but also you are not their best friend. I am not their peer but their instructor. You got to make sure that your kind of toeing that line of being friendly without being like a friend. It is weird and it makes me feel weird and it is a little inappropriate for them to be telling me those things.
>
> *Author 1 Memo*: Tug-of-wars/toeing a line—best friend/peer versus instructor/non-formal educator; being friendly without being a friend; feels weird and inappropriate versus being an honor. She notes this as a contradiction she has not reconciled—"I have not quite figured out how to navigate that." She expressed how it would be difficult for the middle school learners to know what is appropriate to share and what is not.
>
> *Author 2 Memo*: Mandy struggled with creating boundaries ("toeing the line") between herself and the students. Mandy attributes the students sharing these personal aspects of their lives to them being comfortable with the educators.

Next, analytical memos were analyzed by two researchers, particularly through the lens of CHAT in that we looked for areas of contradictions, particularly in their development as a non-formal educator. We began by reading each analytical memo, noting and naming contradictions individually (see Figure 3 for an example). Next, we met to discuss the contradictions we individually coded while developing a shared language. We often coded for similar contradictions but named them differently. We found five

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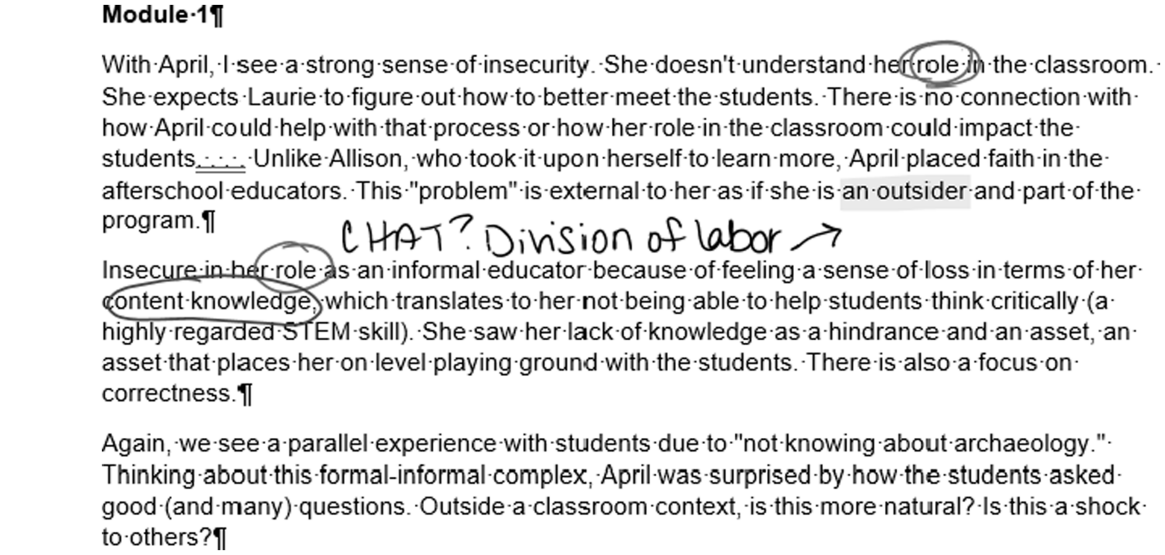

FIGURE 3
Example of initial coding of contradictions from the first author.

contradictions within the data, which are described in Table 2. As such, our approach to the data analysis aligns with the principles of a collective case study in that we began with an in-depth analysis of each participant as a unique case to then consider similarities and differences across cases.

The first author then created contradiction triangles for each university student by looking for contradictions across each of the three data sources and mapping them onto the six components of CHAT—rules/norms, community, division of labor, tools, subject, and object. Consider Figure 4, which represents April's contradiction triangle. This figure highlights four contradictions. These are indicated by the two arrows in the components, rules/norms and tools, as well as the two one-directional arrows on the outside of the triangle indicating a contradiction occurring between two components. As an example, April was concerned with this notion of "right/wrong," which are norms of assessments in a formal learning environment (i.e., rules). This in return shaped her pedagogical moves as she often questioned when to step in to provide guidance and when to step back to allow for student- exploration. In addition, while educator versus friend (division of labor) was noted throughout April's three data sources, it did not seem to be a contradiction as it allowed her to connect with students. See Online Resource 1 for each participant's contradiction triangle.

4 Results

The insights gained from our analysis are organized according to the research questions.

4.1 Research question 1

In this section, we attend to how undergraduate and graduate students negotiated their development as a non-formal educational professional within the afterschool program. Through our analysis, we identified four shared contradictions among the university students as they individually and collectively negotiated their development as a non-formal educator within the afterschool program: (a) the learning environment, (b) pedagogical practices, (c) lack of content, competence, and/or experience, and (d) role or position. Our analysis underlined a central contradiction that shaped and informed the shared contradictions discussed below, namely navigating formal or school-based norms and expectations and non-formal norms and expectations. This will be highlighted within each contradiction.

4.1.1 Environment

Although the afterschool program did not include assessments or standards to be addressed, some university students felt constrained and controlled by the four walls of a school room. This setting was often contrasted with their felt role as an educator when they were facilitating activities outside. As stated by Kristy "It has been easier to interact with the students outside." It was as if there was a particular way to act and behave as an educator as "defined" by the physical setting as opposed to some role in facilitating students social, emotional, physical, and/or cognitive growth as part of an afterschool program. As expressed by Karri during a seminar class:

> I feel like in formal institutions there are expectations, more strict expectations on how you interact with younger [learners].[3] And then there is also that mental mind state that I think both roles [learners and educators] are when they are in that sort of setting,

3 As authors, we were intentional to use students to refer to university students and learners to refer to middle school learners. However, within the quotes of university students, they often use students to refer to middle school learners. For consistency, we changed participants language in direct quotes from students to [learners].

TABLE 2 Contradictions generated through data analysis.

Contradiction	Defined	Analytical memo example
Pedagogical approaches	This encompassed contradictions in which they questioned how they should interact with the children.	Contradiction arose here in that she tried to take a step back (as we have discussed in seminar), but in doing so, nothing was being accomplished, so there was a felt need to step in. Felt, such as in a belief or an impression.
Environment	This contradiction highlighted the struggles within the environment, physical setting, and culture of the afterschool program.	Being in a more formal setting—school—seemed to shape how they acted and related to students. The environment itself had an in-grained culture she felt beholden to. There are expectations and rules in regards to what is appropriate as an educator and she felt constrained to those expectations and rules.
Lack of content/ competence & experience	This contradiction highlights how a perceived lack of content knowledge and competence in working with middle school learners impacted their interactions.	Insecure in her role as a non-formal educator because of feeling a sense of loss in terms of her content knowledge, which translates to her not being able to help students think critically (a highly regarded STEM skill). She saw her lack of knowledge as a hindrance, but also as an asset, an asset that places her on level playing ground with the students.
Friend vs. Educator	This contradiction highlights the liminal space of not being viewed by middle school learners as their friend, but also not being viewed as an educator leading the program.	She acknowledges how the balance between friend and educator was difficult as she wanted to be liked (accepted). Once that line was crossed, she struggled as they took too much leeway.
Role	This contradiction highlights a lack of understanding regarding their role in the program (e.g., formal or non-formal educator). They felt unclear on what they were expected to do within the program.	She did not know what she was supposed to do in terms of her interactions with the students. She describes these feelings as opting to remain in the shadows of the program and not get involved as much.

> which I think we notice a lot when we went outside versus being in the classroom. And I think that even if we are making an effort as educators not to act like a formal educator, I think being in that location and that sort of environment will have us dip back into it.

As implied in this last line, there is a rubber band effect of being in a school environment, namely, educators are pulled back to a learning experience framed by the norms and expectations that they experienced as a student in a school setting. This was also reflected in their language such as instruct, lesson, assignment, fear of being wrong, and correct answers. For example, Roselyn reflected, learners "only wanted to complete certain lesson plans, but I'm still trying to push them to do their best and to at least try to complete the poster."

The notion of time was also frequently mentioned by university students, which seemed to be a byproduct of their view of the environment, namely being confined within the four walls of a formal environment. There was an idea that as a program, they needed to get through everything planned. As stated by Allison, "Maybe next time we should not give them as much time in the beginning. We want them to be able to brainstorm and observe, but maybe we just cut it down a bit to make sure we get through the whole lesson." The use of "lesson" implies Allison's perspective as situated in a formal context and having to get through the material. In a similar vein, Amelia stressed keeping students on-task because time in the afterschool program was limited. Time was also associated with product-oriented thinking as opposed to process- oriented thinking, particularly when middle school learners were tasked with creating posters of their research projects. For example, during a seminar class, April stated, "They're moving like a little slow and I want them to make sure they finish their project in time." For Karri, this contradiction was a tug-of-war between engaging in the research itself (process) and completing the poster by some externally imposed due date (product).

In return, university students' pedagogical practices were governed and shaped by what they perceived appropriate as an educator in this liminal space. As expressed by Kristy in her reflection, "I think our own mental/emotional states can really impact how we interact with people and carry ourselves in the moment, so I am going to try to make sure that I come in not with an overly formal mindset." As such, university students' pedagogical practices were bounded by "norms that I feel are expected of me in a school setting" (Karri). They often talked about ways to make middle school learners stay on-task and focused, manage misbehaviors, and complete tasks by making a schedule and/or a to-do list. This formal-non-formal contradiction also gave rise to the university students questioning their interactions with children. As stated by Ameila, "I worried that if I monitored them too much, the club would feel too much like school to them and they'd lose their interest in it. However, I know that without maintaining some sort of attention on the content, the [learners] probably will not get as much out of it."

4.1.2 Pedagogical moves

This contradiction highlights university students questioning their pedagogical practices as a tool in their development as a non-formal educator. It was viewed as a balancing act. As stated by Karri, "It's tricky to find that like balance between giving them independence and freedom to figure things out and also be there to like guide and structure things for them." These opposing forces included taking a step back and allowing for exploration versus stepping in and providing direct information or answers, and when to discipline versus when not to discipline. As reflected by Mandy,

> I found myself during the measuring portion of the activity, rather dominating the project, and doing the work while the kids watched. That's not conducive to their learning, the best way for them to learn is to do it themselves. I did correct myself and step

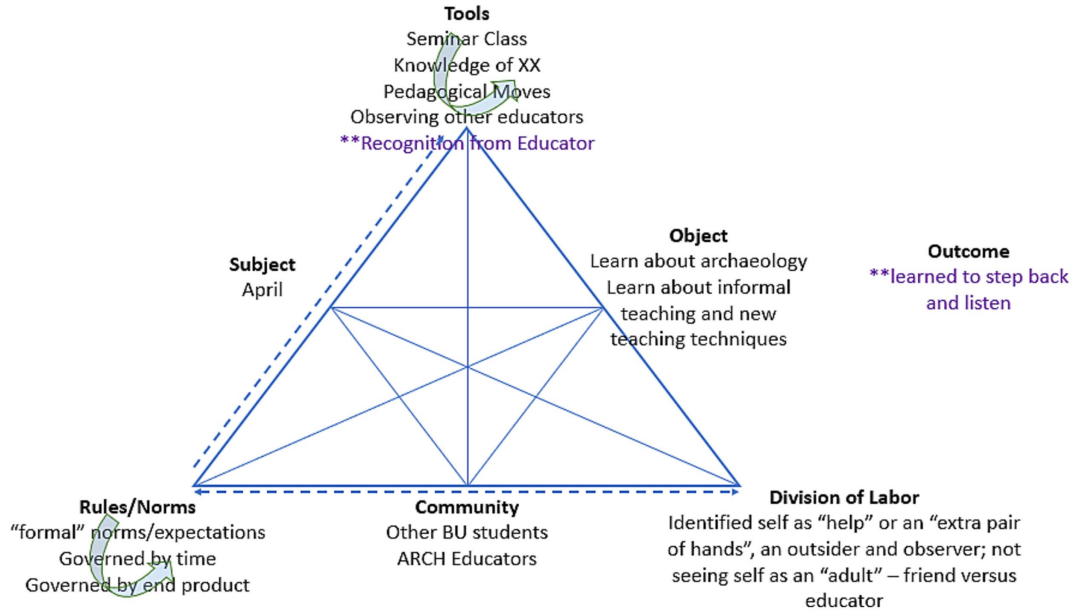

FIGURE 4
April's contradiction triangle in becoming a non-formal education.

> back and assign them each a task to be able to do it together as a group.

In this instance, Mandy was able to make an in-the-moment pedagogical shift in her interactions with middle school learners and their growth as STEM learners. As another example, Adina reflected, "While I did help answer a lot of questions for the [learners], I think I should've let them think for themselves more. I felt like I was demonstrating too much and should have let them experiment more on their own first." Such quotes were common across all university students and highlight their navigation and contradiction between school-based instructional practices and norms (e.g., direct instruction) and non-formal instructional practices and norms (Jocius et al., 2020). As noted in a memo by the first author, "I am not sure this contradiction arises within more traditional teaching approaches. So the fact that [university] students are exhibiting this tension may be them problematizing what they know to be 'good' approaches."

4.1.3 Lack of content, competence, and/or experience

Another contradiction was grounded in university students' perceived lack of content knowledge, particularly archeological concepts. As expressed by April, a mathematics major, "Pythagorean theorem lesson that we did, where it was mostly math, I felt comfortable and more of a teacher. But some of the other ones [lessons], I kinda stepped back because I wasn't too confident in what we were talking about." There was a sense that they needed to be an "expert" to deliver content to learners as opposed to facilitating the discovery of STEM concepts within archeological activities with the middle school learners, which is entangled within more formal ways of thinking about their role as an educator in this program. University students expressed feelings of internal worry and fear in regard to teaching the students the wrong thing as well as being judged negatively by middle school students for their lack of knowledge. As stated by Callie, a psychology major, in one of her weekly reflections:

> Going into this program, I knew nothing about archeology. This intimidated me at first, because I knew I would not be able to answer questions I got from the [learners]. However, I soon came to realize that I did not need to know everything about the subject, I just needed to be able to come up with questions I could ask back to get them to think.

Getting a student to work through their questions to get to some solution takes a skill that does not require any knowledge of archeology. As expressed by Callie, university students' lack of archeological content knowledge shifted from being viewed as a deficit to an asset or a strength that can be utilized when interacting with the middle school learners. For April and Allison, both mathematics majors, their shift was framed as becoming co-learners of archeological concepts with the middle school learners. "I think they appreciate that we are working together to figure it out. I may not know much about the [animal] bones but I am able to serve as someone who they can brainstorm with, while also asking them some more questions in response" (Allison). In addition, questions became a tool for university students to leverage in their interactions with the middle school learners. As stated by Callie, "I am able to think of better questions to ask the [learners], as many of those questions are questions I have myself."

Additionally, lacking knowledge of archeological concepts also shaped how some university students positioned themselves in relation to others—as an outsider and/or observer (division of labor). This hindered their ability to interact with the middle school learners (tool) as they felt that their university peers and/or educators of the program were better able to support the middle school learners as STEM learners

(division of labor); "[Learners] would be curious…and I would not have an answer for that. Well the rest of them [peers] did" (Callie). There is an us or me (Callie) versus them (other university students) mentality in this reflective statement. This statement was in relation to how she interacted with the middle school learners, or not, in this instance.

Lastly, university students experienced a lack of competence in interacting with middle school learners as non-formal educators. This was often due to their lack of experience in working with this age group. As expressed by Mandy, "I've never like worked with kids or [learners] in this capacity before, so it was definitely something new and really uncomfortable at first. I guess I'm not what you would call a kid person." This contradiction shaped their interactions with the middle school learners with some university students "hiding in the shadows" (Roselyn) and being scared to approach learners. For example, Kristy stated in the second week of her experience, "I still struggle a bit with feeling the confidence and authority to approach them [learners] and begin engaging with them."

4.2 Role or position

University students had a difficult time making sense of their role while working alongside middle school learners. They expressed a contradiction between being a non-formal educator and being a peer or an ally of the middle school learners (Division of Labor). As expressed by Maxine, "I had a hard time figuring out my place as an informal educator. I did not want to be so informal that they [middle school learners] saw me as their friends, but I also did not want to overstep and be seen more as a formal educator." This uncertainty was often grounded in a desire to be liked and accepted by the middle school learners and to not be viewed as an adult and/or authority figure. It was an uncomfortable position for some university students to accept. For example, Kristy stated the following as she reflected on her experience at the end of the program.

> But that dynamic of I am the older one, which I think that it took a while for me to fully accept that role. I do not know if I have completely gotten there yet, but I think being comfortable in that role of being the adult with the kids and leading in that way, it was definitely difficult to step into that for me.

Additionally, the university students struggled to make sense of their role in the afterschool program as they felt unclear as to what was expected of them within the program. This may be situated in a formal environment as university students wanted to be told what to do from an "expert" or an adult in charge of the afterschool program (division of labor). Instead, they were given the directive to interact with learners and to independently enact a pedagogical move that they perceive would enrich the learning environment. This sentiment of uncertainty was still expressed at the conclusion of their experience in the afterschool program. When asked in the post-interview how they defined their role in the program, Karri stated, "I feel like I kind of do not know, still at this point. In some ways, I felt like I was a research assistant. In some ways, I felt kind of like a classroom aide. And in other instances, I felt like a teaching assistant." Kristy noted, "I do not know. That was a dynamic we were trying to figure out. So I think I was supposed to be a supportive role for teaching, and I guess guide or teacher to the [learners]." This sentiment of uncertainty was further highlighted in Kristy's statement through the use of hedge phrases such as "I think" and "I guess."

Lastly, some university students situated their role between a pendulum of being a formal educator and a non-formal educator, swinging back and forth between very different roles based on the activity and location (e.g., inside or outside). This was initially uncomfortable for them and closely tied to the contradiction, pedagogical practices. As stated by Allison:

> Maybe for myself, knowing where the line is, between a formal educator and informal educator and being able to maybe be on both sides of it, if that makes sense, still having them get their stuff done while making it a more fun environment. And I think that's what we did.

This was similar to a sentiment expressed by Amelia: "We were pretty much in the middle, where we tried to keep it light and upbeat and they would have fun, but also wanting to educate them about other interests they have had with archeology or just archeology in general." For others, the pendulum shifted from one end (i.e., formal educator) to the other end (i.e., non- formal educator), namely, the pendulum did not swing back and forth. This is highlighted by Kristy. "I did not feel as formal or professional as I did in the beginning I felt a little less formal with them towards the end."

4.3 Research question 2

Next, we attend to how the contradictions influenced student growth as educators, if at all. In particular, we describe how contradictions between two or more components of individual activity systems (e.g., subject-tools-object) supported their growth as educators (or not).

4.3.1 Professional and personal growth

In general, university students described many ways that being a part of the afterschool program not only supported their professional growth as non-formal educators, but also their personal growth in understanding themselves more. These included becoming more comfortable interacting with middle school learners and allowing them to explore, becoming flexible and acknowledging how it is okay to "go off script," communicating ideas and concepts to different people, developing patience and learning how to deal with difficult situations, and gaining knowledge of archeological concepts. These became outcomes of being and becoming a non- formal educator within the afterschool program and grounded in the contradictions highlighted above. For example, Rosalyn stated:

> When I was participating in the program, I learned a lot of things about myself and how I interact with other people. For example, when I first started the internship, I would tell kids the answers or I would just do the whole thing for them. But if I give them the answer, they will not learn anything but how to depend on someone. This was a bad habit I had, and I did not notice until one day I caught myself doing the lesson for them.

This quotation highlights how a contradiction within the Tools component, namely pedagogical moves, became an approach

perceived as not appropriate as learners will "depend on someone" as opposed to thinking for themselves. It was through her actions and self-reflection that this became a contradiction and an opportunity for growth.

4.3.2 Contradictions

Yet, in utilizing CHAT as a lens, the question is if the university students' contradictions led to "learning in which the learners are involved in constructing and implementing a radically new, wider and more complex object and concept for their activity" (Engeström and Sannino, 2010, p. 2). For three university students, the answer is no, as any contradiction experienced by these participants was not in relation to their specific object. For example, Karri's object was learning about the logical aspects of developing such a program and how such programs can be adapted during the process to account for complications and needs. Through her experience, Karri's contradictions were framed within her role as a non-formal educator (e.g., pedagogical approach of stepping in or stepping back) as opposed to gaining access to the ins-and-outs of developing such programs, particularly in school settings. As another example, as a mathematics major, one of April's objects was to gain knowledge about archeology. However, this object was not reached through her experience as a non-formal educator. In the post-interview, she continued to express how her lack of content knowledge in archeology was a hindrance to her interactions with students. "…by the time I learned it, I wasn't really able to help the kids, because I was learning at the same time as them."

For six university students, contradictions supported them in meeting their object, and even develop outcomes framed within their roles as non-formal educators such as new pedagogical moves or developing professional dispositions when working with middle school students. Maxine's object, for example, was to expose middle school learners to archeology at a young age and to potentially inform their decisions to pursue archeology as a career. This was tied to her personal experience as she did not realize archeology was a career path until her sophomore year in college. She did not want the middle school learners to "end up like me, changing their major a million times just to figure out what they want to do." Through Maxine's experience in the afterschool program, specifically the contradictions she experienced (see Online Resource 1), her object was turned into two outcomes—(1) served as a role model in terms of her knowledge of and experience with archeology, and (2) gained confidence in talking about archeology with middle school students. As another example, Adina participated in the afterschool program as she was seeking an opportunity to interact with students as it aligned with her career goal of becoming an elementary teacher. Through her interaction with students, contradictions gave rise to two outcomes: learning to take a step back and being okay with students making mistakes.

Lastly, for one university student, Mary, contradictions led to the transformation of a new object. Mary's original object was to fulfill a graduation requirement, an internship course. She had no prior experience interacting with children beyond her niece and nephew. In her second week of the program, Mary stated in a reflection, "I feel like I'm so inexperienced working with kids that aren't my niece and nephew that everything I do is new. I'm learning on my feet." Through her experience and contradictions (e.g., best friend/peer versus instructor/informal educator, struggle with "letting go") in the afterschool program, Mary's transformed object was to support middle school student thinking as archeologists and STEM learners. This new object led to growth and development of two outcomes—(a) patience and flexibility, and (b) communicating concepts in understandable ways.

5 Discussion

In this study, we used CHAT, an underutilized theory in non-formal learning environments (Ash and Kelly, 2013), to understand how undergraduate and graduate students negotiated contradictions through their experiences as a non-formal educator within an afterschool program. We framed the university students' experience through their active participation and reflection in a community-engaged course (Sanford and Sokol, 2017; Tran et al., 2019). Through this study, we argue that feelings and experiences with uncertainty and dissonance are an acceptable approach to support university students' growth and development as non-formal educators. As such, experiencing struggles and dissonances, often perceived as a hindrance or a barrier, should instead be part of university students' engagement and development (refer to Galman, 2009 and Pedder and Opfer, 2013 for a similar argument in formal learning environments). It may also serve to support university students' understanding of themselves as a professional and their role within their profession (Sutherland and Markauskaite, 2012; Virta et al., 2023).

Due to the lack of substitutive training, non-formal educators tend to fall back on their own lived experiences in a school-based environment (Bevan and Xanthoudaki, 2008; Hwang et al., 2020; Lachapelle et al., 2019; Plummer and Small, 2013). This lack of training encourages educators to draw upon their experiences as a student. They will likely make inferences of what it means to teach and attempt to implement those perceived notions even though the role of student is not the same as the role of an educator (Lortie, 1975). Non-formal educators rarely are provided the opportunity to participate in reflective professional development sessions that goes beyond a top-down approach (Allen and Crowley, 2017; Tran et al., 2019).

University students in this study made sense of their experience as non-formal educators through both individual and collective reflections. Results highlighted shared contradictions among university students as they individually and collectively reflected upon their development and growth as non-formal educators within the afterschool program. These shared contradictions were more broadly situated within navigating professional boundaries and practices within formal or school-based norms and expectations and non-formal norms and expectations. Kerosuo (2001) expressed this as a "place of division between what is familiar, and what is unknown" (p. 53). In this case, the familiar being formal or school-based norms and expectations, and the unknown being the norms and expectations inherit in non-formal learning environments. Further, Simpson and Feyerabend (2022) has previously described this as a tug-of-war where we question and reflect upon our various roles while being pulled or tugged toward dominant norms and practices, typically of school-based environments. As well-established in educational research, as learners and developing non-formal educators, our experience of the teaching-learning process is often framed and bounded by the many hours of being a

student in a classroom setting (Lortie, 1975). It may be difficult to step outside and question what you know to be "true" of the teaching-learning process (Botha, 2020). Alternatively, prior experiences as learners in non-formal learning environments (e.g., summer camps, library programs) may also not be an experience that university students can draw upon. Yet, it may also be the case that reflecting upon one's prior experience and their beliefs regarding their "truths" may serve as filters for new learning (Feiman-Nemser, 2001; Mewborn and Tyminski, 2006). Future research studies may consider this as part of their ongoing growth and professional development with university students as they grapple with navigating different contradictions.

Results also highlighted university students' professional growth as non-formal educators (e.g., allowing exploration, gaining knowledge of archeological concepts) and personal growth in understanding themselves more (e.g., patience and flexibility) through reflecting on their practice. Based on prior research regarding participation in authentic experiences and learning activities (e.g., Dwolatzky et al., 2021; Hwang et al., 2020), as well as reflective practices (e.g., Georgii-Hemming et al., 2020; Nelson et al., 2016; Van Beveren et al., 2018), growth in such skills and practices was expected. Future research should continue to examine how these short-term benefits extend to professional and/or personal long-term impacts, including how, and if, they continue to engage in non-formal learning environments as an educator. As described by Sancar et al. (2021), professional development and growth is a lifelong process; therefore, a longitudinal study would enhance our understanding of how continual professional development that extends beyond the university setting shapes and informs the professional growth of individuals as non-formal educators.

Similarly, results exposed how being a part of the afterschool program and reflecting on practice supported only some of the university students' initial goal(s) for volunteering their time. This raised the question; how do professors support them in their professional growth and development through active engagement and active learning opportunities? Being aware of individual and collective goals (i.e., subject-object) of the university students may highlight ways to introduce particularly mediating tools within the experience to create dissonance and contradictions to support the transformative development and growth as non-formal educators (Roth and Lee, 2007; Salloum and BouJaoude, 2023). One approach may be through utilizing Brookfield (2017) four lenses of critical reflection, particularly moving beyond personal reflection to understand middle school learners' experience.

5.1 Implications

The results of this study have several implications for how universities support their students in their professional growth and development as non-formal education professionals. One, university students may need to experience dissonance and contradictions through their involvement in afterschool programs and other out-of-school learning environments (e.g., museums). Two, instructors of community-engaged courses should provide opportunities for students to self-reflect individually and collectively with their peers (e.g., Georgii-Hemming et al., 2020; Van Beveren et al., 2018). This may include a 30-min discussion, a physical or digital interactive "parking lot" to post something that went well and something that could be improved upon each week, or audio-record reflections at the end of one experience for someone to respond to and provide support as needed. Three, universities can provide early and ongoing opportunities for university students to develop pedagogical and instructional solutions for contradictions that arise through their experiences (Allen and Heredia, 2020; Heredia and Tan, 2021) and will inform their continued efforts in working with young children. This becomes a cycle of enactment, reflection, and personal growth (Korthagen and Vasalos, 2005). Four, professors may consider how to bridge formal and non-formal experiences, as well as the differing norms and expectations of non-formal and formal learning environments, as a way to promote university students' development and growth as educators. Similar to Feiman-Nemser (2001) and Mewborn and Tyminski (2006), we contend that educators need to negotiate past experiences of the teaching-learning process with the norms and expectations of new experiences in order to meaningfully contribute to the culture and climate of a non-formal learning environment. Five, the active learning experience for university students were in collaboration with a local school district. This highlights the importance of strong university-school and community-engaged partnerships (Goggins and Hajdukiewicz, 2022). On a practical level, the implications are grounded in providing active learning opportunities within a community-engaged university course. This could include the development of a one- to two-credit academic-service learning course, but also a seminar course and non-formal learning experience that aligns with university students' program of study (e.g., engineering, computer science, mathematics).

5.2 Limitations

First, results from a collective case study are highly contextual and some may claim that the results may not apply broadly to other non-formal environments or university populations. Similarly, a sample size of 10 students is relatively small. However, we contend that our argument statement—feelings and experiences with uncertainty and dissonance are an acceptable approach to support university students' growth and development as non-formal educators—is likely transferable to other contexts regardless of the non-formal learning environment or university population. Transferability refers to the extent to which the findings of a study can be applied or generalized to other contexts, settings, populations, or situations (Merriam, 1998). Transferability is not about ensuring universal applicability but rather about providing enough information of the research context, data collection and analysis, participants, and findings for others to judge the potential relevance of the findings to their own context. It is also the case that this research provides a baseline understanding of how university students negotiate their development as non-formal educators, additional research within other universities and non-formal learning environments may lead to multiple realities and/or grounded generalizations (Eisenhart, 2009). Second, researchers' interpretation of the results, as well as the data collection process (e.g., reflection questions), may introduce bias. One way to reduce bias within the data analysis process was through investigator triangulation (Denzin, 1984), which refers to the use of multiple researchers to

analyze and interpret the data. It honors our own lived experiences, expertise, and lens as researchers. Third, the three data sources were grounded in students' reflections on their experience as non-formal educators. While we contend this was a strength of this study, particularly with our focus on professional growth as a reflective practice (Finlayson, 2015; Georgii-Hemming et al., 2020), this may also be viewed as introducing social desirability bias or the tendency for participants to provide responses they believe are more socially acceptable, desirable, or favorable rather than providing answers that reflect their true beliefs, feelings, or behaviors. As a research team, we included strategies to minimize social desirability bias such as different members of the research team collecting the data, detailing the purpose of the study and how confidentiality and anonymity would be maintained, establishing rapport with participants, and probing for more information and examples to support their responses (Bergen and Labonté, 2020).

6 Conclusion

Within this study, non- formal educators (i.e., university students) were provided a 10-week reflective professional development grounded in their experiences and observations within an afterschool program. During that time, the university students' experienced contradictions that shaped their development as non-formal educators, with several recognizing their professional and personal points of growth. The definitions of their role osculated throughout the experience culminating in a stronger sense of self and purpose. As noted, university students are students, so in addition to the hope for middle school learners to gain experience in STEM concepts as part of the afterschool program, university students can also gain the experience as educators through an active learning approach. By providing them the space to construct their own meaning and their own positions as participants and educators in non-formal learning environment, university students will likely grow and develop as educators through feelings of uncertainty and dissonance. With the large number of non-formal education opportunities for youth learners (e.g., 7 million school-aged children were enrolled in an afterschool program; Afterschool Alliance, 2020), it is our hope that this study can encourage additional research in this vein of discovery in an effort to understand the possibilities that a non-formal educational setting could provide for university students.

Data availability statement

The datasets presented in this article are not readily available because as included in consent documents, "identifying information might be removed from identifiable private information and, after such removal, the information could be used for future research studies, but only studies in which Dr. Simpson or Dr. Miroff is involved." Requests to access the datasets should be directed to Amber Simpson, asimpson@binghamton.edu.

Ethics statement

The studies involving humans were approved by Binghamton University Institutional Review Board (STUDY00002367, Approved 22 May 2020). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AS: Conceptualization, Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing. JM: Formal analysis, Writing – original draft. DM: Formal analysis, Writing – review & editing. LM: Funding acquisition, Project administration, Writing – review & editing.

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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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1444537/full#supplementary-material

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