



Research Perspectives in Urban Education

An Artist/Researcher Model for Participatory Action Research in Transdisciplinary Learning Contexts

Abstract

Participatory action research and the arts are tools to bridge power divides found in disciplinary learning where many students have traditionally been excluded (e.g., STEM). In this study, we apply an Artist/Researcher model as a way of positioning individuals within a social context, anchoring their identities around shared values and epistemic practices. Situated in four after-school projects with Chicago Arts Partnerships in Education, we explore how an Artist/Researcher model that is rooted in constructionism can lead to new ways of considering how artwork itself might enhance the aims and processes of participatory action research. We find that the Artist/Researcher model supports transdisciplinary learning in ways that foreground student agency and social dialogue in community: through materials and design choices; representing self as expert, leader, and creator; co-opting activities and transforming participation; and engaging with art and science as tools for social change. This study has implications for applying constructionism to participatory action research in out-of-school settings and for designing interdisciplinary or transdisciplinary learning experiences.

Keywords

participatory action research, arts education, transdisciplinary learning, out of-school settings

How to Cite

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Participatory action research (PAR) is a strategy often used to center the voices and knowledge of teachers and students (Galletta & Torre, 2019). As a participatory methodology that focuses on the lived experience of those traditionally excluded from power, PAR can shift power toward those who, in a hierarchical system like education, are most marginalized (Galletta & Torre, 2019). Like PAR, the arts are a tool for examining and shifting power in learning settings. Creative arts promote reflection (Sullivan & McCarthy, 2007) and can empower student voices when applied to social or political contexts (Dahn, 2022; Travis, 2021). The arts are applied in transdisciplinary learning toward bridging power divides where many students have been excluded from disciplines like STEM (science, technology, engineering, math) (Calabrese Barton & Tan, 2019; Mejias et al., 2021). While there are often tensions with PAR in school settings, out-of-school settings are flexible, focused on student interests, and often have social and emotional aims like cultural competency and mentorship (Murray & Milner, 2015).

This makes out-of-school time (OST) settings a natural fit to explore designing for transdisciplinary environments using both PAR and the arts.

We approach learning in OST settings through a constructionist lens, centering artifact creation and the constructed meaning-making and learning that occurs while making (Kafai, 2006; Papert & Harel, 1991). In the arts, learners imagine what is possible while creating an artifact, shaping it and imbuing it with symbolism and perspective (Halverson & Sheridan, 2022; Sheridan 2020). While the arts are often used as tools in action research (Lee et al., 2020; Tang Yan et al., 2022; Wang et al., 2017), the centrality of the artifact in constructionism offers a new way to consider how artwork itself—as an object to think with, communicate with, and reflect with—might enhance the aims and process of PAR. Prior studies do not demonstrate a connection between constructionism and PAR.

In this study, we propose applying an Artist/Researcher (A/R) framework (Sikkema, 2016; Sikkema et al., 2021) to center the individual learner who takes on identities of both artist and researcher through the process of creating in a transdisciplinary learning context. We hypothesize that the act of making art (or artifacts) might increase learner agency and that the artwork itself might support students taking a more critical or socially connected perspective on STEAM learning. In this paper, we apply an A/R model along with transdisciplinary and constructionist approaches to the following questions:

- How can an Artist/Researcher model be used to codify an approach to action research in out-of-school transdisciplinary learning?
- How does an Artist/Researcher model support transdisciplinary learning in ways that foreground student agency and social dialogue in their communities?

Background

Participatory action research (PAR) is an approach that democratizes research through participation (Galletta & Torre, 2019; Walker, 2009), with respect to who gets to engage, what questions are asked, and how data are collected and viewed by community members. The purpose of action research is to address questions and solve problems within social contexts. In the context of this study, the A/R engages in research by asking questions and framing findings; they engage in action through their art and the messages they imbue, as well as conversations had while sharing artwork with community audiences. While arts can be used in various ways toward research, this study views the art itself and the process of making art as research (Baker & Lin, 2022; Wang et al., 2017). Arts-based PAR has been shown to help students discover and express themselves while gaining confidence and engaging with their communities (Lee et al., 2020). It can also increase critical consciousness, or the understanding of how

participants' experiences are enmeshed in the social, cultural, and structural worlds around them (Tang Yan et al., 2022). Through these broader understandings, action research extends beyond discipline-specific learning domains.

Within transdisciplinary learning contexts, art-making in its many forms is a productive way to build bridges with other disciplines such as civics or science, as it can support engagement with social issues and social dialogue with one's community (Darts, 2006). Research in arts education has argued that art-making can support critical analysis and inquiry into social issues relevant to young people and the world in which they live (Eisner, 1988; Freedman, 1994; Greene, 1995). The social issues around which young people develop art (e.g., climate change, immigration, public health) stretch across disciplinary boundaries as the art-making process supports the development of new designs and ways of thinking about social problems. Through social interactions with others and materials, students cultivate individual agency as they make sense of learning across disciplines. This individual and social process of art-making supports their deepening understanding of themselves in relation to the world in which they live.

Youth are often drawn to OST learning environments through interests that they hope to develop, such as the arts, sports, or STEM subject areas (Ito et al., 2020). As such, many OST providers seek to center the youth in the design of learning experiences, empowering students to take an active role in their own learning, and encouraging youth to ask questions, explore topics, and discover knowledge in their own way (Afterschool Alliance, 2022; Philp & Gill, 2020). OST programs have the potential to become "youthspaces" where students apply their local knowledge toward social justice and social change through art and creative research practices (Goessling, 2020). This can be particularly humanizing and important for marginalized youth (Goessling, 2020; Tang Yan et al., 2022). In these ways, the design of interest- and inquiry-driven OST learning experiences bear the hallmarks of transdisciplinary learning environments, where students and educators work collaboratively to explore topics that cannot be adequately understood or addressed within the confines of a single discipline (Quigley et al., 2017). They can also navigate the complexities of the real world by fostering adaptability, creativity, and the ability to approach problems from multiple angles.

OST settings also offer the freedom to reimagine the possibilities for transdisciplinary STEAM learning. Individually, STEM and arts learning are often approached from discreet disciplinary perspectives aimed at developing interests, skills, and knowledge around a particular subject. Even well-intentioned STEAM educational approaches that attempt to unite the disciplines often prioritize one over the other, frequently using the arts as a vehicle to teach STEM (e.g., Mejias et al., 2021; Perignat & Katz-Buonincontro, 2019). In an attempt to synthesize epistemic practices from STEM and arts disciplines, Bevan and colleagues (2019) describe a framework for epistemic intersections between STEM and arts practices, which they categorize as exploratory, meaning-making, and critiquing.

Student agency emerges by engaging in PAR and is both an individual and social phenomenon. Individual subject areas can provide the contexts and tools in which students apply their agency (Calabrese Barton & Tan, 2010; Sheridan et al., 2022). What it means to have agency changes depending on context and individuals' socially constructed identities, as well as their positionality or power within the space or disciplinary domain (Calabrese Barton & Tan, 2010). Critical student agency in learning settings occurs when students take their knowledge, culture, experiences, and relationships and apply them to tasks, structures, and values of the learning environment (Calabrese Barton & Tan, 2010). While most disciplinary agency is measured by a student's ability to incorporate the knowledge, practices, and tools of a domain (Calabrese Barton & Tan, 2010; Dahn, 2022; Sheridan et al., 2022), agency in arts learning experiences is also observed by the process of creation and reflection (Sheridan et al., 2022) as participants move toward authoring experiences and seeing themselves as leaders and creators (Sheridan et al., 2013). While studio arts teachers often promote agency through supporting autonomy (Sheridan et al., 2013), developing agency is highly social and situated in the relationships and communities both within and outside the learning setting (Calabrese Barton & Tan, 2010).

Conceptual Framework: An Artist/Researcher Model

Our study is grounded in an Artist/Researcher (A/R) model (Sikkema et al., 2021) that is rooted in constructionist ideas for learning (Kafai, 2006; Papert & Harel, 1991). An A/R model is a way of positioning individuals within a social context and anchoring their identities around shared values and practices. Within action research, the A/R model organizes participation. An A/R makes discoveries by creating artifacts—art, sculpture, textile, poetry, dance, performance—and “conducts investigations through art and collaboration in order to gain new understandings of the world” (Sikkema, 2016, para. 10). Learning among a group of A/Rs occurs through the process of creating and by making meaning, reflecting, sharing, and critiquing with one another (Halverson & Sheridan, 2022).

The A/R model (see Figure 1) was developed by a team of teaching artists, arts administrators, and researchers at Chicago Arts Partnerships in Education (CAPE), an arts education nonprofit serving schools and communities in the Chicago area through a unique long-term teaching artist and classroom teacher partnership program. As might be assumed by the name, the A/R model considers the artist as a researcher, approaching art-making and learning by asking critical questions and looking to understand or make something new. For example, in the context of CAPE, the teaching artists and classroom teachers take on the role of the A/R through their joint inquiry in creating and curating curriculum and learning experiences for their students. Though concrete examples are helpful for realizations of the model, the A/R model is not meant

to be applied only to the domain of arts learning but rather describes an identity, a mindset, and a state of being that can reach across subject areas, including STEM disciplines (e.g., combining visual arts, science, technology, and communication at New Sullivan Elementary; see Sikkema et al., 2021). The A/R model is a way of elevating curiosity as a central construct uniting the identities of artists, researchers, and scientists, thus making it a helpful model for framing transdisciplinary teaching and learning.



Figure 1. The Artist/Researcher Model, based on Sikkema (2016)

In the A/R model, teachers, teaching artists, students, administrators, parents, and research partners can all become A/Rs. With this identity, they take on a set of qualities, and become:

- *Reflective Questioners*: the A/R approaches art learning and making through inquiry. They ask questions, revisit questions as they learn and create art, and, in the end, they reflect and create new questions.
- *Critical Collaborators*: collaboration with other A/Rs (e.g., artists, educators, researchers) is vital to stretching an A/R's point of view, highlighting both

contradictions and agreements and developing comfort with disagreement and dissent.

- *Role-Shifters*: the arts facilitate role shifts and perspective changes. As A/Rs, students, artists, teachers, and researchers swap roles: sometimes a student may become the teacher, or a teacher may become the student. All are artists.
- *Integrative Innovators*: innovation comes when multiple ideas or disciplines come together. An A/R brings the assets of the arts together with other academic disciplines to imagine new ideas and create original artwork.
- *Social Engagers*: art can be a tool to engage the public and establish a dialogue with the broader community. The A/R uses both art and the artmaking process to connect beyond the learning space.

The five A/R qualities are non-sequential, part of an A/R identity, and often occur simultaneously. Since it was developed in 2016, CAPE has applied the A/R model toward developing and maintaining partnerships, developing teaching and curricular plans, curating student art shows, and teacher and teaching artist professional development. Within a research-practice partnership (RPP), both the team of practitioners and the team of researchers take on an A/R identity. We approach developing our problems of practice and lines of inquiry together and in alignment with the model, which is a tool for our RPP's commitment to RPP qualities as laid out by Coburn and colleagues (2013). The A/R model supports our partnership's commitment to mutualism as well as our intentional strategies for partnership (e.g., how we develop research protocols and author together).

At this point, CAPE has applied the A/R model extensively in arts learning contexts, but the A/R model also has great potential for being applied to other disciplinary domains and transdisciplinary learning. This is inherently built into the model, particularly in the areas of collaborating, shifting roles, and innovating. Science and technology are natural extensions for the model, with reflective, critical questions central to experimenting, exploring phenomena, and understanding science's role in the world (Calabrese Barton & Tan, 2010).

Methods

The work reflected in this paper is rooted in an RPP (Coburn et al., 2013) between CAPE, an arts education nonprofit located in Chicago, Illinois, and Creativity Labs, a research lab at a university in Southern California. In this longtime RPP, we approach our work with the same goals and collaborate to determine our research inquiry, rooted in problems of practice, artistic concerns, or contemporary social issues that are important

from both practitioner and researcher perspectives. CAPE applies our collective inquiry toward program themes that guide professional development and reflective inquiry for teaching partners while planning their curriculum. Creativity Labs creates research protocols to better understand student and educator experiences and how this inquiry makes new contributions to the learning sciences. We also work together to co-design professional development for CAPE’s teaching artists. The cases in this study occurred between 2017 and 2023, as our mutual inquiry focused on themes of openness and space-and-place.

Participants and Setting

CAPE was established in 2002 and currently has a faculty of nearly 50 teaching artists who are placed at schools throughout Chicago, both during the school day and in OST settings. Teaching artists work one-on-one with classroom teachers to plan arts-integrated lessons, build collaborative learning environments, and support students, parents, and the wider school community. Within these partnerships, teaching artists and teachers embody the A/R model (Sikkema, 2016; Sikkema et al., 2021) in their approach to collaborating, planning their curriculum, and engaging students.

Table 1. Overview of Case Contexts

Context	Participants	Chicago Neighborhood
Case 1 Art and embroidery	Elementary, 6 th grade	The Bush
Case 2 Adult art class	Adults, mostly women	Little Village
Case 3 Photography	Middle School, 7 th grade	West Roseland
Case 4 Art and Running Club	Mixed grade levels, 4 th -8 th grade	Little Village

Each case highlighted (see Table 1) is situated in an arts-focused after school or community class. In OST contexts, teachers and teaching artists have more flexibility in their curricular and pedagogical choices (Bolin & Hoskings, 2015), allowing the teaching artist and teacher partners to be open to one another’s interests, student interests, and the unique affordances of a given school site or community. While they are first and foremost arts learning environments, each one of the following cases is also interdisciplinary and transdisciplinary, bringing in elements of science, technology, or mathematics learning alongside the arts, and also connecting to deeper socioemotional, sociohistorical, or other cultural contexts.

We focused on one teaching artist for this study with four cases set in different OST learning settings. The teaching artist, Jessica, was also on the original administrative team that conceived the A/R model and is the second author of this paper. Cases were selected because they are transdisciplinary learning contexts, focused on arts plus either science, math, or technology. Additionally, the programs in each case were planned using the A/R model where we hypothesize that social engagement and shifting roles will translate to students experiencing agency, social dialogue, and community action. For each case, Jessica planned and taught alongside different teaching partners who incorporated various interests and spurred unique transdisciplinary connections. For example, one classroom teacher's love of running catalyzed mapping activities and zine making. In another class, Jessica's teaching partner specialized in ecological science, driving the connections to urban nature in their artmaking.

Data consisted of 1) one 30-minute interview between Jessica and one of her co-teachers; 2) notes taken while planning a conference presentation on the A/R model; 3) images collected and presentation created for the conference presentation; 4) notes taken during the presentation; and 5) notes from a one-hour interview where we guided Jessica through the images and descriptions of each case. To answer the first research question (i.e., how an A/R model might lead to new ways of working and collaborating in transdisciplinary after-school contexts), we applied the A/R model to each case, discovering moves Jessica and her collaborators made in planning each program, and student situations, like interests, community connections, or disagreements, that shaped the ways participants collaborated and worked with one another. To answer the second question, we looked at each case for instances of agency in arts and science learning (Calabrese Barton & Tan, 2010; Sheridan et al., 2022), and instances of social community dialogue (Dahn, 2022). The first author analyzed the data and conducted regular member checks with the second author. This study is registered and approved as protocol #20205624 with the UCI Internal Review Board.

Findings

To answer the first research question, how an A/R model can be used to codify an approach to action research in transdisciplinary OST learning, we dig into four different cases. While each project touches on most of the five qualities of the A/R (reflective questioning, critical collaboration, role-shifting, integrative innovation, and social engagement), we have chosen to draw out one specific quality in each case to illustrate each quality fully.

Reflective Questioning: The Power of Words + Perseverance

Textiles and handicrafts have a history of connecting physical making and arts practices with mathematics and computation (e.g., Keune, 2022; Peppler et al., 2020). Additionally, they draw on cultural and sociohistorical practices from myriad cultures. For sixth-grade students in an afterschool art club at an elementary school in a small neighborhood adjacent to South Chicago called The Bush, students created art through embroidery. They learned artistic elements, like materials choice, color, texture, and stitch. They also learned fundamental mathematics needed for the project, including situating their design within the space available in their embroidery ring, planning for the length and width of each letter, and choosing and counting stitches.

This lesson was not just about disciplinary learning. *Reflective Questioning* entered the project in the planning, making, and presenting of student work. The teaching partners started the project with the inquiry questions: What are the uplifting words we need to hear and see daily? and How can problem-solving through embroidery translate into problem-solving and perseverance in our daily lives? By starting with these questions, students centered an emotional need, rather than starting with physical design, to imbue the object with meaning. Students were prompted to create a composition using power words and to embroider their words onto an object, like a washcloth, that they may use in their daily lives. As students embroidered, they thought about their power words, considering what they wish they heard daily, or what a family member or friend might need to hear.

As students worked through the process of creating their embroidered power words, some encountered problems seeing their visions through. Midway through the project, one of the teachers found student work in the trash can. This led to a discussion around value, both of the work and for the materials. This student picked up their original work, realizing it was not disposable and they didn't have to throw out their work when something went wrong. They removed stitches where needed and continued. The finished product said, "It will be okay" (see Figure 2). Another student planned to write "art." (See Figure 2). They started with confidence but ran into problem after problem and wanted to give up. Eventually, this student did complete the project, but the back of the piece is covered with loose and knotted extra embroidery floss. In the end, the teaching artist asked, "How can we tell from the art that you persevered?" and the student responded, "Because it's done." The reflective questioning led the student to see both the struggle and strength of perseverance.



Figure 2. Embroidered Power Words - "It will be okay" and "art"

Critical Collaboration: One Page, One Tree at a Time

The natural sciences and the arts united in a community arts class in Chicago's Little Village when a teacher with a background in ecological science and a visual arts teaching artist came together to work with a group of local women. This adult art class was entirely comprised of Latine women, most of whom identified as mothers or caregivers. In this unique learning context, *Critical Collaboration* was particularly key, not just between the teaching partners, but also in a community of 20 adult participants who brought differing preconceived ideas and critiques of what comprised good or valuable art.

Understanding of trees and plants around them went a long way toward connecting participants to the art projects. The students were enthusiastic about drawing and painting nature. Bridging ecological concepts and human nature became a way to examine what was happening in the participants' lives and communities. Participants saw connections between plant-based organisms and real-life experiences, which then became the subjects of the artwork they made. In one project, they used a novelty book called "How to be More Tree" where every page highlighted a different tree species and related a human quality, like the strength of that tree. Students painted trees, making metaphorical connections to Mother Earth and their own roles as mothers and matriarchs in the house. They also explored creating natural pigments from local plants and painted manifestos they wrote.

Another dimension of critical collaboration came at times of disagreement and negativity that the adult students directed at one another's artwork. When issues came up, the teaching partners returned to ecological concepts as metaphors for negativity or judgment. They talked about variables like bacteria entering ecosystems and related that to social issues like criticism and even bullying behaviors. The teacher then explained that with art, "It's about what you wanted to say or express, not about the quality of the drawing or painting." The students then realized that compliments work the same way, with positivity infusing the collective artistic culture. This led to greater skill in artistic critique.



Figure 3. Artwork Featuring Plants and Trees

Role Shifting: Stress + Healing

Media arts are a natural home for bridging art and technology (Peppler, 2010). In a seventh-grade after-school photography class in the West Roseland neighborhood of Chicago, students explored photography from an artistic perspective (e.g., subject, composition), as well as from a technological perspective (e.g., camera function, digital editing). *Role Shifting* is particularly poignant in this context. Students began by shifting roles with one another, sometimes serving as photographers, and other times acting as subjects. As students became more familiar with the DSLR cameras, teaching partners began to step back into an observer role and students began teaching one another.

Once they had learned the camera technology, a group of boys became more interested in the creative affordances of digital technology and decided to learn how to use a green screen application on their teacher's phone (see Figure 4). The students shifted roles again as they learned the technology and then used the app to document what was happening in class. They learned to animate their images and change backgrounds. They learned it on their own and taught it to their peers, eventually directing them in their shoots.

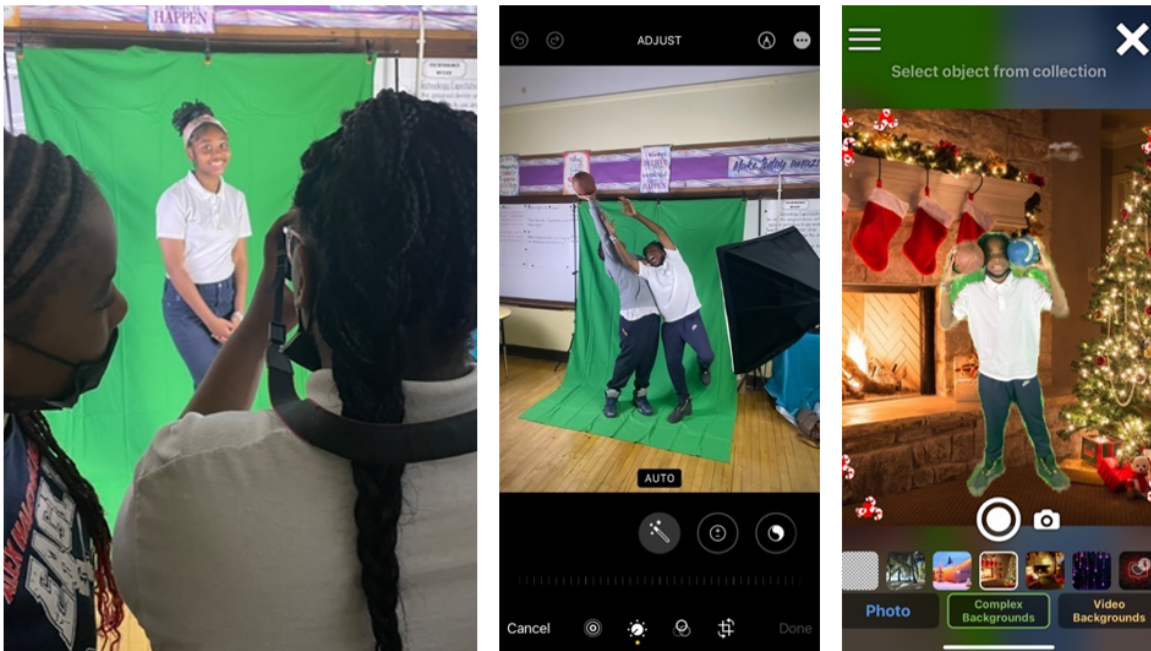


Figure 4. Student Green Screen Images

As students became more sophisticated in their practice, they examined the artwork of a range of photographers—including that of their teaching artist—identifying, unpacking, and discussing symbolism in the art. The students created images with symbolism around stress and healing by bringing in objects from home that made them feel comfortable or that relieved stress and that told something about who they are, conveying meaning to an audience or user.

Sometimes the diversity of interests in a teaching partnership leads to unexpected innovation. When around 30 fourth- to eighth-grade students joined an after-school art and running club in the Little Village neighborhood of Chicago, the teaching partners were not sure what would happen. All they knew was that the teacher wanted to run and the teaching artist wanted to make art. By embracing these interests, *Integrative Innovation* was allowed to flourish into a whole new take on an art club.

Innovation that integrated both running and art, and eventually urban mapping, emerged as the students hit the pavement on their runs. At first, students brought prior knowledge of their neighborhood into the classroom where they made maps from memory and negotiated the features and distances on the map with their peers. Next, they turned to technology, using Google Earth and Google Maps to explore roads, landmarks, barriers, and changes over time by projecting maps onto the wall, drawing out features, and dropping pins. Students also pushed to capture their families outside the neighborhood boundaries and to put themselves and their own homes on the map.

This project grew from experimentation. Each time the students went out for a run, they added layers to the map. Sometimes, they added sensory layers, noting what they smelled and heard in different parts of the neighborhood. They took photographs of houses and journaled, engaging in creative writing prompts about the neighborhood. Students ran with chalk, and, prompted to “make your mark,” they logged their journey on GoPro cameras for a running video diary. They created art with found objects and discovered the color palette of the neighborhood as they were inspired by “Colors of the Southside” artist Amanda Williams.



Figure 5. Maps and Found Objects from the Art + Running Club

This creative approach to multisensory mapping led to a zine project, where students wondered how they could develop a deeper sense of community and self through experimentation with art and running. Running in the community meant encountering people in the community, opening opportunities for *Social Engagement*. This often came with confronting negative narratives about kids as troublemakers. As the students ran, they made connections, meeting and talking with local businesses and spreading the

idea that kids are also an important part of the community. The art and student maps became a tool of communication. The zines told stories of their personal discoveries, interests, and growth throughout the program. When they shared their zine, there was pride in the sharing of self. Students would approach a stranger, engage in conversation, and say, “I just want to share something with you.”

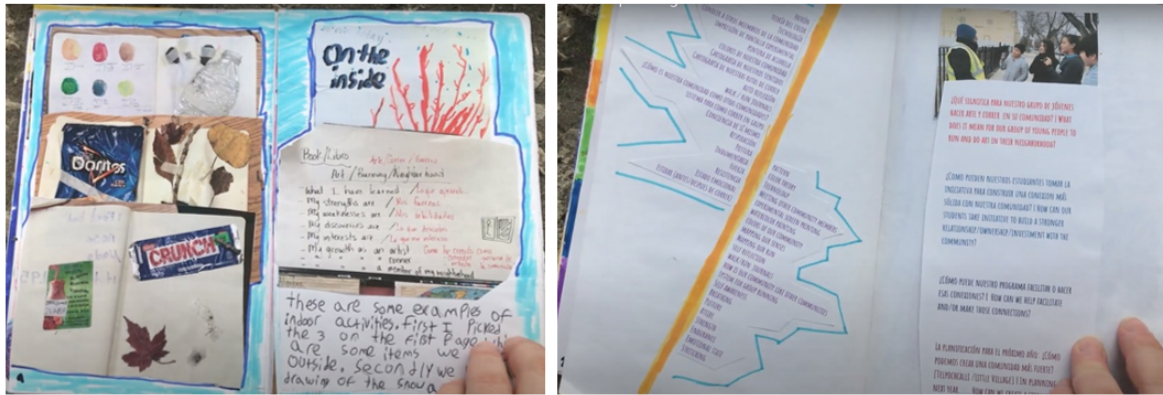


Figure 6. Pages of the Student Zine

Student Agency and Social Dialogue in Community

The A/R model supports transdisciplinary learning in ways that foreground student agency in four distinct ways. First, aligned to constructionist principles, students take agency through *materials and design choices* as they create their artifacts or artwork. In the transdisciplinary learning setting, materials may be art-making tools, like paint, embroidery thread, or cloth, but materials also include technology, found objects, and tools for measuring and mapping. In the design process, students don't just find agency through materials, but also by expressing their ideas and through messaging (e.g., power words in the embroidery project).

Second, in transdisciplinary settings, students find agency by *positioning themselves as experts, leaders, and creators*. This combines indicators of agency in science learning with the self as expert (Calabrese Barton & Tan, 2010), with agency indicators in the arts of seeing self as a maker and creator (Sheridan et al., 2013). This sense of empowerment is clear in the photography class where the students stepped into roles of peer teacher, photographer, and director. In the adult art and ecological science class, expertise came first as they observed trees and created natural pigments, but their agency transformed even more when they understood that as artists, creativity came from generating and expressing their thoughts and ideas and making something to communicate that to others.

A third way the A/R model foregrounds student agency occurs as students *co-opt activities and transform participation* in different learning and community settings. In the photography class, the students took over the activities of teaching one another and began designing and directing photoshoots. The knowledge they gained about green screen technology meant that they could infuse the shoot with personal items and backgrounds of their choice. The students in the running club transformed their participation based on where they ran, who they encountered, and what they brought back to the classroom with them. Like the students in Calabrese Barton and Tan's (2010) science study, they applied their socially and culturally situated knowledge of the local streets, businesses, and people to the maps they made and the artwork for their zine.

The fourth way that the A/R model foregrounds agency is in conceiving of *art and science as tools for change*. Students in the embroidery club found agency to make a message that they hoped would help others. In the adult class, the students found agency in collaboration, with the instructors and one another, as they supported each other's efforts and built a new community of citizen scientist-artists in their neighborhood.

While all five characteristics of the A/R model support foregrounding social dialogue in community, this is directly attached to becoming a "social engager." In the embroidery project, the teachers arrived at social engagement by way of another A/R characteristic, reflective questioning. Students engaged in critical questions around creating uplifting messages before designing their artifacts. They imagined a dialogue where their artwork would communicate a simple message of hope and considered where those messages would be placed (e.g., a shared sink in their family home, a teacher's lounge). Social dialogue was communicated directly through the artifact. An example of a more bidirectional dialogue is evident in the adult art class where students engaged in social dialogue with one another by drawing metaphors between natural ecologies and family or community ecologies, opening a dialogue about strength and disease in systems.

The art and running club offers an expansive picture of the possibilities for foregrounding social dialogue in transdisciplinary OST settings. The students started with their own prior knowledge of the neighborhood and engaged in listening and observing as they ran, took different routes, and collected images, notes, and found objects. They also saw the ways adults reacted to a group of middle school students running through the city streets. As they brought data for mapping and ideas for art-making back to the classroom, they also brought skepticism from business owners who were concerned about kids running, and fear from newer community members who reacted to kids running toward them. These reactions, in a rapidly gentrifying Little Village neighborhood of Chicago, spurred the students to seek more active dialogue. Their teachers helped them talk to local business owners about what they were doing and as students saw the same people each day they ran, they started waving and asking questions. When the students finally produced their zine, it told the story of the running club, including their maps and artwork. As they shared copies of the zine with people on

the streets, these artifacts facilitated active exchange between students and their community members, changing perceptions of one another and creating authentic exchanges.

Discussion

In this paper, we've put forward an A/R model that supports new ways of understanding participatory characteristics or roles in action research in out-of-school, transdisciplinary learning settings. In each case, participants engaged in discipline-specific learning in arts and STEM and created art that engaged them in a broader social conversation. While each project employed all five qualities of the A/R model to some extent, most emphasize two or three depending on the context of the project.

In the case of the adult art class, the roles of critical collaborator, reflective questioner, and social engager led participants to make metaphorical connections between themselves and their families and communities, developing a critical consciousness as creating art led them to understand something new about how they fit into their neighborhood and environment. In the photography club, the students were role-shifters, stepping into instructor and director roles, social engagers who brought personal artifacts into their shoots, and integrative innovators who discovered new ways to engage with and tell portrait stories through greenscreen technology. In the art and running club, the roles of social engager, critical collaborator, and integrative innovator were particularly prominent for producing artwork that pushed students to engage their community in dialogue. Students developed critical student agency (Calabrese Barton & Tan, 2010) in the process of researching their community, applying prior knowledge, and collaborating with their peers. Once the zine was produced, students were empowered to share it, in some cases letting their message speak for itself, and in others entering into dialogue with community members.

Central to the purpose of applying the A/R model in action research is the creation of the artwork. Applying a constructionist lens emphasizes the affordances of the creative process where the "action" becomes the art itself. The process of making and sharing supported the development of student agency through materials and design choices, positioning self as experts, leaders, and creators, co-opting activities, and conceiving art and science as tools for change. Artwork becomes a tool for social dialogue, either communicating a message imbued by the artist, or engaging artist and audience in discussion.

Conclusion

The A/R model has clear implications for supporting action research in OST settings and for designing interdisciplinary or transdisciplinary learning experiences. Foregrounding agency and social dialogue in art-making serve both action research and transdisciplinary STEAM goals. By centering the creative process, engaging in artistic practices, and making art, the students in our study answered complex questions and engaged with their broader community; lending structure to planning for arts-based participatory action research. As a tool for designing interdisciplinary or transdisciplinary STEAM learning programs, the A/R model is a tool for exploring, making meaning, and critiquing, supporting epistemic interactions between STEM and arts.

Acknowledgement

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