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Shannon K. McManimon

ABSTRACT

Our museum-based participatory research (PR) project was a collaboration between researchers and educators in an out-of-school time STEM education program for young people that positions STEM as a tool for community social justice. This project drew on literatures on reflective practice in museums and on research-practice partnerships. Yet following existing approaches did not work for us. Aligning research and pedagogical practices, we co-created practical, reflective, and practice-based data-generation methods, calling them "embedded research practices:" context-specific, emergent methods rooted in practice that served practice and research needs and centered shared axiological commitments. Four examples are outlined. Embedded research practices echo assessment in informal learning, emphasize the interaction of research and practice, call attention to the emergent and co-created nature of PR, and serve needs for professional learning for museum educators.

Museums are learning institutions with many staff who are learning professionals. Like other learning spaces, museums must consider not only what their visitors learn, but what and how their staff learn. Museums are also grappling with centuries of exclusionary practices and thus a need to center equity and inclusion.[1] Increasingly, museums are incorporating reflective practice and/or research-practice partnerships to address these needs.[2]

We, practitioners and researchers collaborating on a research project with a museum-based, equity-focused informal STEM education program, did too. Following the literature on research-practice partnerships, we chose a research approach to help us iteratively design and learn together. Yet we found that the "rules" – the norms and procedures outlined in literature – weren't a good fit for us. We thus threw out formal research-based terms and some of the practices we were trying to follow and instead developed localized, equity-centered tools. We came to call these "embedded research practices." Embedded research practices are context-specific, emergent methods rooted in practice that serve needs of both practice and research in our museum-based setting as well as our axiological commitments, particularly to equity. They became process, method, and sometimes product that helped us address considerations specific to our informal learning environment and working contexts.

While write-ups of research often sanitize messes or hide complexities, we believe we are not alone in our struggles with enacting equitable partnership or with wanting methods or tools that fit local needs. Thus, this article aims to provide a concrete example of how we adapted and co-created research methods that fit our commitments and practices in a museum-based educational program. This article first outlines the research project we proposed and how it fit with our axiological commitments. This project drew on literatures on reflective practice and on research-practice partnerships in museums. Yet when following the best practices of these literatures didn't work for us, returning to "the why" of our work reminded us to align our research and pedagogical practices. Thus, we designed and utilized new tools (i.e. methods) that enabled us to practice our equity and collaboration commitments and situated the work more firmly in informal learning. Four examples of these embedded research practices are rotating paired conversations, "What, Gut, So What, Now What," graffiti walls, and a Four Corners activity. The article concludes with the impact of this process of co-creation on the museum-based educators in our project.[3]

Our proposed research project and axiological commitments

Our project was a three-year, grant-funded collaboration involving dozens of researchers and practitioners[4] in the Kitty Andersen Youth Science Center (KAYSC). The KAYSC is an out-of-school-time pathway program housed at the Science Museum of Minnesota in which young people (school-aged through young adult) who have been historically marginalized in STEM (i.e. BIPOC [Black, Indigenous, People of Color], girls, and/or young people from low-income families) use STEM as a tool for social justice in their communities. High school-aged young people work in small groups (often for multiple years) in four STEM content areas: engineering and design; environmental studies and sustainability; human biology and public health; and media and technology. Through hands-on learning, they investigate ways that STEM content, knowledge, and skills can be used to change the world. Examples include designing a hydroponic system to grow microgreens for another local afterschool program, facilitating technology workshops for other teens at a local library, organizing to raise the minimum age to purchase commercial tobacco, or presenting at a national conference on harmful ways (e.g. skin bleaching creams) science has furthered colorism.

Both our project and the work of the KAYSC are based on axiological commitments that are the "why" behind what we did in both practice (with young people) and research. They included a rejection of narrow, Western conceptions of science, expanding STEM by exploring ways communities have always and currently use STEM.[5] This also reflects the perspective that STEM (formal) education in the United States has often "overlooked or downplayed the importance of social justice in the field," which may limit access to and success in STEM for historically marginalized groups.[6] These beliefs necessitate historicizing and politicizing equity, calling for both individual and structural change to address current and past injustices.[7] We returned over and over to these "whys:" We do this work based in ethical commitments to social justice and to equitable STEM learning for young people who use that learning to serve their communities. We were looking to produce knowledge for those who also want to connect STEM and social justice.

Conceptualizing research as "with" rather than "on," we planned to explore how this program's practices connected STEM and social justice and engaged young people in science through iteratively redesigning the program's learning practices and implementing them internally and then with an external partner. Both adults and young people in the program would be co-researchers, designing together.[8] We would also document how the process of collaborative research affected practitioners and researchers. Practitioners would refine their practices in real time; young people would gain research experience; those in the formal role of researcher would contribute to theory-building in informal STEM learning. We would center learning and reflective practice throughout our collaboration, drawing on what other research has found.

Reflective practice and research-practice partnerships in museums

Unlike formal education teachers who generally must have very specific credentials and follow a set path for their profession, many museum educators do not have an analogous or mandated path of study specific to the museum setting or need museum-specific credentialing (e.g. degrees) prior to their museum employment (and are likely not mandated by law to complete ongoing education once hired). Their own schooling was likely based on the norms and practices of formal education, which operates from different logics and theories and definitely with different desired outcomes than those of informal learning. Further, insufficient relevant professional learning opportunities, particularly those based in the workplace, contribute to the brain drain and high turnover of young professionals in nonprofit organizations.[9] As in schools, professional learning experiences for museum-based educators are often one-off, based in deficit perspectives or transmission models, and burdensome in terms of time and cost.[10]

As in formal education, museums have increasingly emphasized reflective practice as a means to address these and other challenges. Yet without institutional support, resources, and time, this form of professional learning often falls by the wayside over time.[11] One way of incorporating this work into museums is through jointly-negotiated partnerships between researchers and practitioners to study learning. These partnerships conceptualize practice and research as multidirectional, rather than a more traditional model of research *on* practice; this approach can be both more equitable and ethical.[12] Often, a goal in such work is not only to contribute knowledge about learning to education and content fields, but for participants to reflect on their own learning in their specific, local contexts. This work is based on a premise that research, theory, and practice are not distinct entities but are instead intertwined and all necessary for supporting equitable teaching and learning.

Through iterative processes of working in community, these partnerships (often called RPPs, research-practice partnerships) build common, shared language and routines; form a community of learner-educators who trust each other to try out new practices and reflect on them; cultivate leadership capacity; and support informal educators in feeling validated in and having ownership over their work.[13] In other words, these partnerships (can) lead to changes in thinking, in language, in participation, and in behavior.[14] They are particularly successful when there is organizational support for these culture changes and for making practice public through programs that combine structure, flexibility, and preparation.[15]

Yet such projects involving practitioners and researchers are not a panacea, but are also notoriously messy, context-specific, and bound by practical constraints, particularly the limitations of time. Other common constraints include a need for shared language/definitions; internal logistical challenges (differing work and communication styles, schedules, and timelines); external logistical challenges (e.g. demands of grant funding); and various power imbalances.[16] Further, participants who are not formally trained as researchers often experience anxiety and skepticism for reasons including research's inaccessibility, its (perceived) impracticality or irrelevance, and long histories of exploitative, extractive research.

The evolution of our research process

We were aware of both these affordances and concerns going into our collaboration. Indeed, when our project asked a group of newly hired KAYSC museum educators what came to mind when they heard "research," their responses were not surprising: nervous, time-consuming, anxious, secure (because it's based on facts or validated), skeptical, curious, dry. Further, as a BIPOC-led, BIPOC-centered, and majority BIPOC space in a museum that has been an historically and predominantly white institution, KAYSC participants had experience-based fears about tokenization and ongoing marginalization and how the research project might replicate these inequities.

We believed reflective practice and partnership could help us address such concerns in our work together. Turning to our shared values, we attempted to mitigate challenges by building relationships (e.g. having fun together and sharing food); naming our different goals for our shared work; building meeting times around practitioners' schedules; and trying to call out real or potential power imbalances.[17]

We spent over a year following the strategies available in literatures and conversations, but found that the parameters outlined in the literature did not fit with what we were doing. We adapted our approach, but those of us in the role of formal researcher still struggled to schedule interviews and observations (traditional research methods) and to get buy-in for our joint work. Despite the ways we endeavored to jointly design our research processes, including its questions, practices, and products, practitioners did not find our project useful in their day-to-day work and pushed back on what we were designing together as well as the purpose of our project, seeing it as an add-on to already demanding jobs. At the same time, when we talked with other researchers, many asserted that what we were doing was not following protocols or accepted research practices found in the literature.

Not wanting to get caught up in the minutiae of academically naming what we were doing, we let go of our adherence to other people's definitions for our research and attempts to conform to specific methodologies. Instead, we called our work what many fields do: participatory research: "a research process which involves those being researched in the decision-making and conduct of the research, including project planning, research design, data collection and analysis, and/or the distribution and application of research findings."[18] Participatory research (PR) focuses on collaborative processes of local knowledge-building, is based in trust and reflection on everyday experiences, requires sharing power and decision-making, and builds participants' capacity to conduct and use research.[19] In other words, process is as important as outcomes and

learning is key. As one co-researcher stated early on, "we're trying to build space for everybody to collectively design and bring all the different perspectives … and strengths to the table."

We believed that our research, in both process and content, had to align with our personal and shared commitments to equity and social justice – to our values – as well as to the KAYSC's pedagogical practices. We jointly reconceptualized what we were designing, reconfiguring our work to focus on the professional learning needs of informal educators, particularly a need for reflective practice.

To do so, we turned to what we knew about the KAYSC's pedagogical approach in its daily work with young people in the museum. KAYSC educators used strategies that encouraged constructing meaning through multiple ways of knowing and focused on participation, collaboration, and listening. We decided to adapt these approaches for data generation. This would serve multiple purposes: it would make our participatory research spaces look, feel, and sound like the informal learning practices of the KAYSC; it would give all of us practice in facilitating or watching these (learning) activities facilitated; and it would embed collective data generation into activities that looked like, were, or could be part of the day-to-day practice of informal educators.

In informal learning, techniques to assess what and how learners are learning are most practical when embedded into activities as an integral part of the experience; traditional measurement instruments (such as quizzes or surveys) "tend to be at odds with the engaging, continuous, and exploratory nature of these environments."[20] Thus, we began to embed research methods into already-existing KAYSC practices and values that were familiar to practitioners, eventually calling these methods "embedded research practices." This name has multiple meanings: (1) it echoes the practice of embedded assessment in informal learning experiences; (2) it explicitly emphasizes the interaction of research and practice; (3) it calls attention to the emergent nature of this work – the *practice*, both doing something and also trial or repetition; and (4) it serves practitioners' need for professional learning, meaning-making, and reflection.[21]

Embedded research practices: practical/practice-based methods

On the surface, these embedded research practices might be indistinguishable from pedagogical or practice-oriented activities that might occur in meetings or learning activities. As such, they also relieved anxieties about the formality and dryness of research, allowing us to build collaborative relationships and to minimize hierarchies. At the same time, they generated data that moved forward our research goals of building knowledge and co-designing social justice-based STEM learning activities. Following are four examples.

(1) Rotating paired conversations: The KAYSC commonly uses "one-on-ones" to build relationships between staff members and also between educators and the young people in the program. These check-ins are informal but scheduled. We borrowed this practice for research, calling it rotating paired conversations. These supplemented interviews, which tend to be researcher-led, eliciting information from participants (in this case, KAYSC staff). We wanted a less formal way of understanding how our PR was affecting all of us. Thus, different pairs or trios of researchers and practitioners had open-ended conversations about challenges, opportunities,

and meanings of our joint work, providing wide latitude to discuss ideas. Over time, each of us exchanged ideas one-on-one with many different people in a way that was free-flowing, informal, and relationship-based. We audio recorded and transcribed these conversations for later coding to help us answer our research questions, including how we were understanding our participatory process.

(2) "What, Gut, So What, Now What:" When researchers and practitioners met together monthly we had great, energizing conversations about how the program's learning practices connected STEM and social justice. And too often our ideas and conversations were forgotten once we left the room. Further, while we had tried various report-back mechanisms for educators to share their daily work with researchers so that we could understand how the program design was working, researchers spent more time tracking down activity reports than actually using them for designing iterations of the program's learning practices. Without capacity to be present in all practitioner meetings or to sort through voluminous notes for what was relevant to our project, we researchers were left without data. We turned to a form of reflection that the KAYSC regularly uses with young people. "What, Gut, So What, Now What" answers what participants did together (what), how they feel about it (gut), its personal and collective meaning (so what), and next steps or ideas (now what). At the end of each meeting (whether a KAYSC staff meeting, a joint design meeting, or a researcher team meeting), participants together recorded answers to these questions in an online form. As a research tool, this form provided synopses of events and meetings in an easily useable, retrievable, and sortable form and served as an in-the-moment reflection tool for both young people and adults.

(3) Graffiti walls: Another pedagogical approach of the KAYSC is to involve the whole person (body, mind, emotions, and spirit) and to do group work. A frequent tool is "sticky walls," large fabric sheets covered with an adhesive onto which paper can be stuck. We began using these for data collection. For instance, we wanted to look for common themes across workshops we were co-designing for informal educators at our partner site. Individuals and then groups brainstormed ideas. After placing them on the sticky wall, we moved them around, grouped them, and expanded upon them. This collaborative activity involved physical and intellectual movement. The research team took pictures or physically moved the walls to record the data after we finished. Multiple practitioners named this strategy as one of the most memorable aspects of our work together.

(4) Four Corners activity: Our work in the first years of our project and a subsequent collaborative reconceptualization led us to shift to developing professional learning opportunities for informal science educators (both internally and externally) who were connecting STEM and social justice. Practitioners then lead the resulting workshops (with a corresponding toolkit). A member of the research team regularly attended meetings in which practitioners discussed what they were designing. However, sometimes we researchers got the impression that this was an imposition or that practitioners were repeating conversations for our benefit. Instead of a meeting or a more traditional interview or focus group to ask questions, we used the teaching activity Four Corners. For instance, to inform our understanding of informal educators' professional learning needs and thus development of workshops and written materials, we asked, "Which area (STEM content, youth development,

social justice, other) did you have the most support from museum co-workers in developing?" The museum-based educators moved to the corner of the room corresponding with their answer and discussed their choice. Audio recordings captured the verbal representation of ideas in practitioners' language while movement provided a visual representation of the group's alignment and differences. This research practice simultaneously generated data answering a research question about informal educators' needs, provided a space for practitioners to reflect, modeled a pedagogical strategy they could use in practice, reflected values of the KAYSC (such as movement being part of learning and jointly constructing knowledge), and provided material for the toolkit we were developing for informal educators.

Our embedded research practices allowed for deeper reflection, increased rapport, and shared engagement and co-creation. They also provided practical, hands-on tools (products) that practitioners could adapt for their work with young people, responding directly to their request that professional learning be built into our research project. Embedded research practices demonstrated the importance of systematic data collection and joint analysis, grew from and with learning (particularly for museum educators) as the foundation, and valued our epistemological and axiological commitments over methodological ones.

Co-creating embedded research practices

While we continued to use some traditional methods such as interviews and joint coding of data in our PR project, these methods often proved too rigid or counterproductive to the values we were working to embody and to building partnership. With embedded research practices, we reframed joint participation, built around our shared commitments to equity and social justice and to recognizing STEM all around us, and prioritized practitioners' needs, professional learning, and lived experiences.

This developed trust. As one practitioner said, "research has been alongside us." Another museum-based educator told the researchers that "you've definitely broken down a lot of those barriers, and made yourself very approachable, and [research does] not seem as scary or intense." A process of co-creation helped practitioners "buy in and feel ownership" according to a program administrator. It reframed our work. As another program administrator asserted, "It's not this research project in the [KAYSC], like no! This is a research *process*, right? Not a project but a process we're going to [use to] get us to the point where we have the capacity to do this work on a whole new level … ." Through activities and asking questions, researchers and practitioners thought and talked differently about their work, and we co-created tools for other informal STEM educators.

While not always easy, we built a collective understanding of participatory research that empowered us all and spoke back to narrow definitions of STEM and of research. Our embedded research practices – perhaps what could be called grounded methods[22] – emerged from the process of being immersed in a community partnership in the museum. Drawing on local contexts and beliefs, they furthered the work of research and practice. Daring to abandon what was not working for us, to be uncomfortable, and to seek alternatives to traditional frameworks and processes enabled us as museum professionals to learn together and to align our practices. We are excited to

read and hear about how other museum practitioners are also co-creating their own, localized, emergent practices based in collaboration and equity.

Notes

1. See, e.g., special issues of the *Journal of Museum Education* volume 42, nos. 1 and 2.
2. See, for example, Grabman et al., "Culture of Reflective Practice"; Tran, Gupta, and Bader, "Redefining Professional Learning"; and Tran, Werner-Avidon, and Newton, "Successful Professional Learning."
3. Authorship in PR projects is an important site of negotiation, collaboration, and power-sharing. In our project, we have agreed that I, now a university-based researcher and the project's Principal Investigator, am primarily responsible for writing academic articles, with consultation from co-researchers. Research briefs or products for practitioners have other authorship and collaboration, frequently joint. I thought carefully about negotiation and power-sharing throughout the project, especially as I am a white, doctorate-holding researcher who is older than nearly all other co-researchers and a relative outsider to the KAYSC.
4. Practitioners in this context are museum-based educators.
5. See, e.g. Medin and Bang, *Who's Asking?*.
6. McGee and Bentley, "The Equity Ethic," 8.
7. Philip and Azevedo, "Everyday Science Learning."
8. Specifically, we began our project using Design-Based Implementation Research, which to that point had largely been used in formal education, but which we believed could and should be used in museums and other informal environments. See Fishman et al., "Design-Based Implementation Research."
9. Tran, Werner-Avidon, and Newton, "Successful Professional Learning," 333.
10. Tran, Gupta, and Bader, "Redefining Professional Learning," 135.
11. Moore et al., "Supporting Facilitators"; Tran, Gupta, and Bader, "Redefining Professional Learning." See also the *Journal of Museum Education* special issue on professional development in museums, volume 44, no. 2.
12. Bevan, "Research and Practice."
13. Grabman et al., "Culture of Reflective Practice"; Tran, Gupta, and Bader, "Redefining Professional Learning"; Tran, Werner-Avidon, and Newton, "Successful Professional Learning."
14. Tran, Werner-Avidon, and Newton, "Successful Professional Learning."
15. Tran, Gupta, and Bader, "Redefining Professional Learning"; Tran, Werner-Avidon, and Newton, "Successful Professional Learning."
16. Bevan, "Research and Practice"; Bevan et al., "Enriching and Expanding the Possibilities"; Coburn and Penuel, "Research-Practice Partnerships"; Ryoo, Choi, and McLeod, "Building Equity."
17. Vakil et al., "Rethinking Race and Power."
18. Bourke, "Reflections on Doing Participatory Research," 458. Italics in original.
19. Bergold and Thomas, "Participatory Research Methods"; Bourke, "Reflections on Doing Participatory Research"; Krishnaswarmy, "Participatory Research." Other designations include "jointly negotiated research" (Bevan et al., "Learning through STEM-Rich Tinkering") or "co-produced research" (Thomas-Hughes, "Ethical 'Mess'").
20. Zapata-Rivera, "Embedded Assessment," 1.
21. Pattison et al., "Design-Based Research Study."
22. Charmaz, *Constructing Grounded Theory*.

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About the author

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