

From Enrichment to Essential: The Value of the Arts in Education and Learning

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Abstract: This symposium positions the arts as central to learning. Arts-based education has been shown to cultivate creativity, empathy, and cultural awareness, while supporting academic achievement and well-being. Despite this, the arts remain marginalized in curricula, with funding cuts and narrow evaluation frameworks obscuring their value. Responding to calls to advance knowledge on learning in and through the arts, this symposium seeks to demonstrate approaches to valuing the arts through six contributions that show methodological and theoretical innovations, alongside purposeful partnerships, that capture the value of arts-based education. The symposium will include roundtable presentations within a participatory fishbowl and co-creation of a tangible emotional cartography of insights, advancing future directions for evidencing the value of arts-based education through research, policy, and practice.

Symposium overview

The arts are central to how we understand learning and knowing and are therefore crucial to the learning sciences (Halverson & Sawyer, 2022). The arts have long been recognized as powerful contexts for cultivating empathy, creativity, and cultural awareness (Eisner, 2002; Venkatesh et al., 2023). The arts have also supported academic achievement and positively impacted mental health and wellness (Peppler et al., 2014; Fancourt & Finn, 2019). Unlike other domains, arts-based education engages learners in personally meaningful experiences that link identity, community, and imagination (Halverson et al., 2023; Peppler et al., 2023). Importantly, these experiences are also democratic: arts-based education can nurture the pluralism and inclusivity that underpin participatory societies. This value has been affirmed globally; UNESCO, for example, through its 2022 MONDIACULT declaration, emphasizes that culture and the arts are integral to human development, well-being, and creativity, forming the foundation for respect and openness to otherness, which are all skills essential for 21st-century life (UNESCO, 2024).

Despite its crucial role, arts-based education often remains marginal in curricula, positioned as “auxiliary” rather than central (Halverson, Saplan & Martin, 2024, p. 300). One challenge lies in evaluating the impact of arts-based education. As Jindal-Snape et al. (2018, p.60) note, attempts to measure “a range of aesthetic and emotive experiences which themselves defy categorization” risk reducing the richness of artistic engagement and obscuring its intrinsic value, namely, its distinctive capacity to “illuminate our inner lives and enrich our emotional world” (Mowlah et al., 2014, p.4). Compounding this issue, even amid increasing global attention, there remains uncertainty about how the arts are and should be connected to education and assessment (Fleming, Bresler & O’Toole, 2015, p. 1). To address these gaps, more robust and responsive ways of articulating arts-based education, its role, and its purposes are essential.

Building on this prior work crystallizes an important opportunity: To articulate the value of arts-based education through approaches that can capture both the distinctive ‘ways of knowing’ (Wright, 2012) and the “examples of success that are possible” in arts-based education (Halverson et al., 2024, p. 310), while also

foregrounding the broader social outcomes it enables. Making sense of artistic and cultural experiences requires situated, learner-centered, and embodied perspectives in which “senses, cognition, and emotions are developed together” (Chemi & Du, 2022, pp. 6-7). This socio-cultural and situative approach to learning through the arts strongly resonates with the learning sciences (Halverson & Peppler, 2018). As such, the learning sciences are uniquely positioned to advance richer understandings of both how the arts-based approaches shape what can be learned through the arts and how this learning can be made visible and valued.

This symposium responds to calls to further investigate how we can show the value of arts-based education in powerful ways. It brings together researchers and practitioners to share and examine diverse ways of valuing arts-based education, whether through methodological and theoretical innovations or through purposeful partnerships with community stakeholders across contexts. It is our hope that these perspectives cumulatively illustrate how insights from the learning sciences, and particularly attention to learning across contexts, evolving methodological innovations, and a commitment to expanding what counts as evidence, can help reposition this discipline from the margins to the center of discussions about educational design and policy. In doing so, we position the arts not as enrichment, but as essential to understanding the processes and possibilities of learning.

Symposium structure

This ISLS 2026 symposium will consider ways to showcase, strengthen, and nourish the essential value of arts-based education in democratic and socially just societies, bringing insights from highly international contexts. We explore the role of arts with a focus on casting a wide net on the meaning of value of the arts and arts-based education in relation to two broad themes:

1. Valuing arts-based education through methodological and theoretical innovations
2. Valuing arts-based education through purposeful partnerships

Three contributions address the first theme: (1) Kim and Kumpulainen contribute constructive play as a theoretical innovation by reframing children’s engagements through art, where materials act as active, purposeful partners. (2) Thompson, DiCioccio, Graham, and Barber’s contribution reflects on a teen creative writing and science workshop, showing how tensions between scientific ‘accuracy’ and artistic subjectivity can reshape understanding of interdisciplinary learning. (3) Segev and Hod’s work finds that aesthetics serve as a central axis for meaningful learning, fostering learners’ motivation, identity development, and collective belonging. An additional three contributions align with the second theme: (4) Cain, Hsi, and Cain offer an important contribution to this symposium in their examination of how youth developed material fluency and collaborative practices in a co-designed STEAM maker camp. (5) Keune and Staples examine how the purposeful pairing of STEM and arts-based practice can broaden participation and foster civic outcomes, especially belonging and respect for diversity. (6) Zooming out, Peppler, Dahn, and Ito’s *Connected Arts Learning* framework emphasizes how purposeful partnerships between educators, artists, and communities can advance more holistic and socially impactful arts learning. Collectively, the contributions advance the symposium’s aims by showing how arts-based education is both theoretically vital (as a rethinking of play, interdisciplinarity, and aesthetics) and practically essential (through partnerships that foster inclusion, agency, community, and civic responsibility). To enhance consistency and facilitate meaningful comparison, the symposium will also address how validity, reliability, and trustworthiness were ensured in each case.

The symposium will invite the audience to enrich approaches to valuing arts-based education through critical, moderated discussion. The symposium will include a framing and introduction of the contributions by the co-chairs, followed by presentations of the six contributions in a fishbowl format, a form of dialogue often used in unconference formats to ensure active exchange among a large group, with co-chairs, presenters, and the discussant positioned in a circle, and the audience seated around them. Our discussant, Lauren Vogelstein, will then lead the group through her discussion points, employing a dialogical back-and-forth with the authors to carve out possible future directions. Vogelstein brings deep expertise in how choreographic, performative, and embodied methods can generate new forms of evidence and insight into learning processes, particularly those difficult to capture through conventional, word-based approaches. Her insights into designing and studying STEAM learning environments, which value the “A” as much as STEM disciplines, will help guide the group in envisioning new pathways. The discussions will lead to the co-creation of a tangible emotional cartography, which will invite participants to artistically contribute insights, curiosities, and calls for action from the session using tangible arts-based materials from the symposium’s research contributions. The emotional cartography will be exhibited in the arts, gallery, and performance space of the conference and shared online with international partners to continue the conversation.

Constructive play as everyday art practice and materialized memory

Sinyoung Kim, Kristiina Kumpulainen

Context. Arts in education are often positioned as enrichment, which affords supplementary experiences peripheral to the “core” curriculum. However, research in education, aesthetics, and cultural studies shows that creativity and art-making are woven into the everyday lives of children and communities (Eisner, 2002; Saito, 2007, 2017; Pahl & Rowsell, 2010). This paper argues that constructive play should be viewed as an everyday artistic practice, a vital way for children to remember, imagine, and negotiate meaning and cultural belonging. Playing with materials is not just a distraction from learning but a core artistic activity where memory, identity, and imagination are brought to life and transformed.

Research Questions or Objectives

Our study has two main aims:

1. To explore how constructive play as a form of everyday art practice functions as a memory practice that connects experiences across past, present, and imagined futures.
2. To investigate the role of materials in this process, especially how they serve as active participants in artistic and mnemonic reassembly.

Methods. The research draws on sociomaterial and posthuman perspectives that see memory and creativity as relational, performative, and materially mediated (Barad, 2003; Keightley & Pickering, 2012; Prezioso & Alessandrini, 2023). In this view, materials are not passive tools but active participants in memory-making, accumulating histories and inviting imaginative reimagining (Bennett, 2010; Rautio, 2013). Building on the work of everyday aesthetics (Saito, 2007, 2017; Mandoki, 2007), the study highlights that aesthetic practice is not limited to formal art spaces but permeates daily life. Children’s constructive play exemplifies this by transforming everyday materials, such as stones, bones, figurines, and clay, into artistic artifacts that embody memory and imagination. Similarly, artifactual literacies (Pahl & Rowsell, 2010, 2011) show how objects carry personal and cultural stories, becoming vehicles for memory and identity.

The study focuses on a single case: a 15-year-old Mongolian child who relocated to Finland in 2022. Data sources include three constructive play works created across time and place:

1. Stone city (2020, Mongolia): a miniature settlement built from rocks in a rural setting.
2. Stop-motion animation (2024, Finland): featuring a Warhammer 40,000 figurine, reviving an earlier interest in animation.
3. Diorama titled Visitor (2024, Finland): a school project depicting a cloaked Grim Reaper figure, surrounded by crafted miniatures.

Data were generated through child-led visual ethnography, artifact documentation (photographs, video), and a 40-minute elicitation interview. Analysis proceeded in three steps: (1) identification of human and non-human actors in each play construction; (2) mapping temporal and spatial associations of memory; and (3) visualizing relations using Visual Network Analysis (Venturini, Jacomy, & Jensen, 2021). This approach enabled exploration of memory as an emergent assemblage of materials, narratives, and temporalities.

Findings. Two main findings emerged. First, constructive play revealed memory as temporally layered and recursive rather than linear. The child’s return to stop-motion animation in Finland reactivated earlier creative practices in Mongolia, exemplifying Barad’s (2017) “thick now,” where past and present coalesce in ongoing reconfiguration. Second, materials operated as artistic co-participants in memory-making. A bone collected on a beach later became central in a diorama, acquiring new significance and connecting dispersed experiences. A chicken bone was selected for its resemblance in scale to miniature figures, evoking Benjamin’s (1999) “flash of similarity,” where recognition sparks memory. Even unused seashells held latent memory potential, awaiting future activation. These examples demonstrate how memory emerges not solely from cognitive recall but from tactile and aesthetic encounters with matter. Together, these findings highlight constructive play as an everyday art practice in which materials’ affordances, including sensory, symbolic, and affective qualities, enable children to remember and reimagine.

Implications. Our study demonstrates how constructive play is not simply a recreational activity but a form of everyday artistry through which children engage in memory work. By creatively assembling and reassembling materials, children generate constellations of meaning that integrate cultural pasts, present concerns, and imagined futures. The findings align with research in everyday aesthetics (Saito, 2007, 2017; Mandoki, 2007), which shows how aesthetic practices pervade daily life, and with artifactual literacies (Pahl & Rowsell, 2010), which highlight objects as carriers of personal and cultural memory. They also support Vadeboncoeur et al.’s (2017) critique of curricula that marginalize the arts: children’s everyday artistic practices demonstrate that art-

making is not an elite activity but a universal, accessible means of memory-making and meaning-making. Theoretically, the study reframes memory as materially enacted and non-linear. Methodologically, it demonstrates the potential of combining “child-led” visual ethnography with Visual Network Analysis. Empirically, it illustrates how a transnational child negotiates belonging and continuity through everyday artistry. Practically, the findings underscore the need to reposition the arts in education from enrichment to essential. Constructive play demonstrates that children’s artistic engagements with materials are fundamental to cultural continuity, imagination, and well-being. Valuing these everyday art practices invites educators to honour the ways children craft connections across time, place, and experience.

Understanding interdisciplinary learning

Naomi Thompson, Mary DiCioccio, Gabrielle Graham, Jay Barber

Context. STEAM (science, technology, engineering, arts, mathematics) education promises interdisciplinary learning and flexibility for learners to follow their interests and passions (Mejias et al., 2020; Peppler & Wohlwend, 2018). However, there is a tension between the arts and the sciences: The sciences are often viewed as objective fields with “right answers”; the arts are commonly viewed as subjective fields where multiple interpretations can exist simultaneously. Vantage theory (e.g., Johnson, 2002) reminds us that two people, with similar backgrounds, identities, and languages can interpret the same information in vastly different ways. What are the implications of this tension within a creative writing and science workshop for teens designed to facilitate connections between and across the disciplines? In this presentation, we reflect on the first iteration of this workshop and consider past and future alignment between our research methods and our goals of better understanding trans- and inter-disciplinary STEAM learning.

Methods. For this presentation, we engage in retrospective reflection, reviewing data, notes, communications, and other memories and artifacts from before, during, and after the first iteration of this eight-session workshop that took place in Spring 2024 and included eleven participants aged 14-18. Across the workshop sessions, the participants were given opportunities to engage with concepts in both science (specifically about carbon) and creative writing. They heard from guest speakers, engaged in collaborative writing activities, and created final projects. See figure 1 for an image of a collaborative “shape poem” activity in action. The design of the workshop was based on earlier work by one of the authors (Misra et al., 2025). We video-recorded workshop sessions, conducted pre- and post-interviews, and collected participants’ written artifacts after each session to track their writing processes. Early results of this work were shared at the 2025 ISLS Annual Meeting (Thompson et al., 2025), and a more expanded analysis is currently under review. Here, we do not rehash those findings, but instead reflect on how our data collection and research methods impact our ability to understand trans- and interdisciplinary STEAM learning.

Findings. Our reflections have led us to two categories of consideration: capturing writing in process, and wrestling with subjectivity while assessing STEAM learning.

Writing in process. During the workshop, participants wrote by hand in notebooks as they worked on their final projects. Some chose to type up their work at home, but still edited and re-drafted by hand during workshop sessions. We took photos of their notebook pages at the end of workshop sessions. Some students elected to leave their notebooks with us until the following session, while others took their notebooks home. This method had both affordances and constraints for capturing artifacts. On one hand, this focus on physical artifacts created a sense of focus and shared purpose when we had quiet writing time. No computers meant fewer distractions from social media and messaging. However, it also introduced challenges, such as keeping photos of artifacts organized and labeled properly, and occasional missing pages of work from students writing at home or forgetting to bring notebooks back to the workshop. Further, we recognize some potential missed opportunities. Having participants write in a program such as Google Documents would have allowed closer tracking of writing in real-time through the version tracking abilities of the program. While we did video record sessions, those recordings could not capture the process of writing by hand. Further, collecting digital copies of their work would have also been less logistically burdensome on the research team and the participants. From our constructionist perspective, tinkering is a process of learning, and we understand the act of writing, rewriting, drafting, and wordsmithing to be recognizable as tinkering. Thus, having access to more details of that tinkering process would allow us to capture more of the learning. However, it is unclear how the additional complications that digital writing might introduce would interact with increased access to the learning process.

Subjectivity in interdisciplinarity. Science is often viewed as having “right” answers. Alternatively, forms of art such as creative writing are often viewed as subjective and open to interpretation. This may pose tensions when seeking to understand learning in an interdisciplinary setting where both science and art are valued. For example, participants in the workshop were encouraged to play with scientific ideas in their writing. This led

to some uses and explanations of science that were not strictly “correct,” but served appropriate and innovative narrative purposes. What does this imply about whether the youth learned science? They were able to use science to strategically move their stories along; however, they did not always reflect the accepted facts of the scientific concepts they employed. What does it mean to learn about both science and writing in this context? Additionally, what does this mean for how our methods for capturing and understanding learning work in interdisciplinary settings? In this case, we chose not to focus on scientific accuracy but rather considered the *use* of science in the writing projects to better understand how the participants perceived the role of science in their lives and broader society.

Implications. The questions posed here suggest that more research is needed around how we A) see learning in action and B) understand learning that does not fall into neat assessment categories. This work reminds us that in meaningful STEAM educational settings, the arts cannot be separated from other disciplines and that understanding arts learning is essential for understanding interdisciplinary learning.

Figure 1
*Two Participants Working on a
Shape Poem About Prehistoric Animals*



Aesthetics as a driver in maker learning: A study of expert educators' designs

Yuval Segev, Yotam Hod

This contribution examines the vital role aesthetics play in maker education, revealing how they foster significant and deeply engaged learning. While aesthetics are recognized as entangled in the maker process (Kafai, Fields & Searle, 2014), this dimension is often undervalued, with the arts seen as ancillary to technology (Clapp & Jimenez, 2016). Through an in-depth analysis of expert maker educators' designs, we demonstrate the centrality of aesthetics as a driving axis for learning, aiming to better articulate the artful work of these educators (Vossoughi et al., 2013).

This contribution draws from a larger ethnographic study of expert maker educators. In this contribution, we focus on one educator, Tamara (pseudonym), and her semester-long course where 6th-grade students designed and fabricated laser-cut escape room riddles as farewell presents for their school. Data for this single case study includes 10 classroom observations, educator and student interviews, and a collection of student-designed artifacts. Our analysis here addresses the research question: What role do aesthetics play in meaningful maker learning? We report on five phenomena where aesthetics played a significant role in driving deep and resilient learning.

1. Complexification. Tamara positioned students as authentic designers, giving them the agency to envision their own complex riddles. This freedom created a ‘creative tension’ (Kafai, Fields & Searle, 2014), as students’ aesthetic visions often outpaced their technical skills. As they worked to realize their designs, they encountered the push back of materials and technologies, evident when their first laser-cut objects revealed a gap between on-screen plans and physical reality. As one student exclaimed, “I didn’t know it would be so big! On the computer, it looked small.” The drive to achieve their specific, self-defined aesthetic vision fueled their need to problem-solve, transforming technical obstacles into meaningful challenges.

2. Resilience. To help students navigate this struggle, Tamara cultivated a culture of resilience mirroring a design studio. Her discourse was demanding yet supportive. Field notes describe her telling a student seeking

repeated help: “You are giving up on yourself... Now try for three minutes—don't ask me any more questions.” Because students were so deeply invested in the aesthetic outcome of their projects, this demanding environment fostered stamina rather than frustration. Their emotional investment was so profound that one student noted, “I was dreaming about the project last night,” demonstrating the deep engagement this approach fostered.

3. *Personal and Social Meaning.* The project was explicitly framed as a meaningful gift to the school community, connecting students' personal identities to a social purpose. The aesthetic experience was thus rooted in both personal expression and communal contribution. The riddles became tangible symbols of the students' maturity and capability, as one student reflected: “I felt... like wow, I'm doing something really big.” This design decision embedded the learning in an authentic context where the aesthetic value of their creations was directly linked to their social value.

4. *Aesthetic Hook.* Tamara strategically harnessed the aesthetic allure of high-quality production (Blikstein, 2013). The course began not with the main project but with what she called a “pampering project,” where each student quickly designed and fabricated a small, personal artifact. This initial success served as a powerful ‘motivational hook’ (Segev et al., 2025), giving students a tangible taste of the aesthetic possibilities of the tools. This positive first encounter built their appreciation for what Tamara called the “force of this form of creation” and provided the motivation needed for the more challenging work that lay ahead.

5. *Belongingness.* Tamara fostered a warm, family-like atmosphere that became an aesthetic artifact in its own right (Pepler et al., 2023). She established shared rituals, most notably the practice of the entire class erupting in celebratory clapping whenever a student overcame a hurdle. This became a cherished classroom norm. A student recalled this vividly: “I remember that every time someone said ‘I finished’... we would stop for a moment and clap for them.” This co-constructed culture of collective joy transformed the classroom into a space of belonging (Noddings, 2013), providing the encouragement necessary to persevere through difficulties. In this expert-designed course, aesthetics were not an afterthought but a central, driving force.

The five phenomena highlighted here demonstrate how an educator can intentionally use aesthetic experiences to create meaningful learning driven by complex challenges and high engagement. This viewpoint echoes constructionist theories championing personally meaningful projects and advocating for ‘Hard Fun’—the joyful experience of struggling with complexity in the pursuit of passion and self-expression (Papert, 1996). Such an approach fosters motivation, identity development, and deep conceptual learning, repositioning the arts from the margins to the center of educational design.

Crafting for and with others: Centering collaboration and material fluency in a maker camp

Ryan Cain, Sherry Hsi, Meghan Cain

Context. Over the course of two design iterations, two education practitioners (who also identify as learning scientists) collaboratively created and co-facilitated a weeklong STEAM camp (with assistance from a junior educator) that centered art-based methods for engagement with traditional and computational craft materials to learn about microelectronics. This summer learning experience was enabled by a collaborative partnership between a children's science center in the southwest region of the US, a non-profit research organization, an industry technology partner, and two university partners. Grounded in post-humanist theories of material agency (Knappett, 2008; Pickering, 1993) and collaborative knowledge building (Hmelo-Silver & Barrows, 2008), we aim to advance our understanding of how people learn through collaborative design and how material fluency can develop reciprocally between learners in collaborative learning contexts. Here, we define material fluency in relation to agency with materials: ways that learners engage with a collection of materials to express an artistic idea with sustained engagement. Learners may not necessarily be experts with the materials. Rather, they develop a flexible and creative relationship with them that enables learners to build agency and greater material fluency – supporting momentum towards a finished artifact. We examine the interplay between material fluency and collaboration in an analysis of youth maker projects. These cases highlight agency with others and non-humans/materials as they created original electronic-embedded artifacts. In this presentation, we focus on the nature of material fluency in making artifacts and on the collaborations/interactions that occurred in two cases in which youth “crafted for” and “crafted with.”

Research Question. How do designers/instructors support material fluency development in the context of an informal STEAM camp focused on making and microelectronics?

Methods. In a museum-based camp setting, learners were presented with a range of materials to design new artifacts, learn through collaboration, and enact agency through a process of negotiation with the materials and other learners during the creative making process. Over five days, youth created models and actual circuits using various media, including paper-circuit cards, e-textiles, breadboards, and their own bodies.

We documented youths' design work (enacted agency and created materials) using field notes, photography, short interviews, and daily post-instruction logs collected by two instructors and a junior camp assistant (co-author). Drawing on Keune's human-material collaboration analysis (2024), we present mini-case studies selected to illustrate how materials and arts-based practices have shaped outcomes.

Findings. Case 1: Crafting for family, a paper lantern card (figure 1). R, demonstrated material fluency with cut paper and the basic paper circuit, as both materials pushed back on the implementation of her artistic idea. Her idea included an illuminated card for her family, who were about to celebrate Eid Mubarak. On the first day of the camp, we introduced a paper circuit template to build agency and fluency with the materials, followed by a design challenge to create a greeting card for someone they know. In conversation with an author, R explained how she had made the lanterns before with ease, but was having difficulty mounting them as planned in a design sketch. Additionally, she was working to create a more aesthetically pleasing battery holder for the card, eliminating the binder clip. Through continued negotiations with the materials, R made an improved battery holder and mounted the lanterns upright.

Case 2: Crafting with, a mushroom lantern card (figure 2). M, a junior educator, spent the first two days of the camp helping with setup, distribution, and cleanup, but often sat away from the group. During the cleanup on day 3, M noted how R's lantern card was "smart and cool." On day 4, M's role in the camp transitioned from material distributor to near-peer mentor (Clarke-Midura et al., 2018) when helping P fabricate a mushroom card inspired by R's lantern card. M, P, and another youth, L, made toadstool mushroom lanterns. Initially, M was using scissors to cut holes in red construction paper, allowing light to shine through. Another youth suggested a better solution to making the holes with M to "stab a pencil into it and kind of drag it around the hole." The paper "pushed back" on M's scissors, but the new stabbing with a pencil method allowed M to return the material's push. In the end, M made with P to create a thank-you card for P's mother.

Significance. Our two cases highlight ways that youth and materials co-evolve while developing a close relationship to others and the materials they use to learn and create with. Materials shaped the design ideas of youth, allowing them to build fluencies (material and technical) as they made intentional choices in which materials to select in their projects. Akin to post-humanist stances and the concept of agency of material/non-human and human "actants" (Latour, 1996), the materials (and respective objects created with these materials) served as collaborators on equal footing with humans. Here, agency emerges interactionally, dynamically, and relationally between art materials and people.

Figure 2
A family Lantern Card

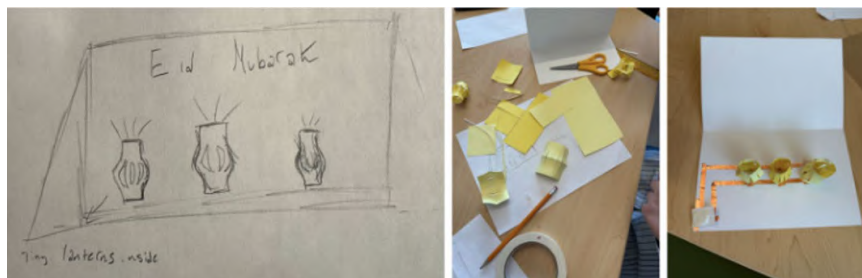


Figure 3
A Mushroom Lantern Card



Fostering civic learning through arts-based approaches to stem

Anna Keune, Harper Staples

Introduction. Science and technology are integral to healthy, well-informed, and publicly accountable democracies (Ross & Fried, 2022). These fields have a direct impact on how public life unfolds, for example, the way city infrastructures can include and exclude some populations while including others (Makkonen & Inkinen, 2024). Understanding and engaging with the civic dimensions of STEM, particularly its socio-emotional aspects, such as fostering a sense of belonging to humanity, is essential for developing inclusive, reflective, and participatory citizens. However, questions remain about how to design approaches that enable children and young people to engage with these civic issues through STEM learning, especially those historically underrepresented in fields such as computer science and engineering (Cheryan et al. 2017).

One promising approach is arts-based education, which has been shown to support civic and community engagement by providing opportunities for creativity, reflection, and expression (Paat et al., 2025). Within STEM contexts, arts-based approaches can strengthen young learners' own sense of belonging in these domains, deepen their understanding of how to foster inclusion for others through technical design, and cultivate a sense of belonging to a broader humanity. Yet opportunities for accessible, interdisciplinary socio-emotional civic learning within arts-based STEM education remain limited. More effective pedagogical interventions and methods to capture learning outcomes are needed to elevate the value of arts-based learning for civic purposes. Such pedagogical and research designs promise to establish a much-needed foundation for evidence-based arts education policy and practice.

Research Objective. Our research responds by developing arts-based interventions and associated research strategies to value arts-based learning for socio-emotional civic learning in both school and out-of-school settings for youth aged 10-13 and 15-18. These interventions aim to support young learners' civic development by fostering participation, encouraging respect for diversity and difference, and promoting reflection on belonging in society.

Methods. We drew on UNESCO's (2015) *Global Citizenship Education (GCE) Framework* to design interventions to foster socio-emotional learning through arts-based STEM activities. The framework provides a holistic model for assessing learning across three domains: cognitive, socio-emotional, and behavioural. We focused on the socio-emotional domain, particularly the concept of belonging, as both outcomes and guiding principles for design. To capture whether the interventions foster belonging across personal perception, design for others, and a larger humanity, we opted to design activities related to STEM fields with current parity issues, namely, computer science, robotics, and construction (Cheryan et al. 2017).

Findings. We developed four interventions to foster the socio-emotional aspect of belonging. Each case study integrates pedagogical practices that combine STEM and arts-based approaches and includes methods for capturing belonging across the three aforementioned dimensions of belonging. Each case study also produced an *emotional cartography* to elevate children's "emotions from the periphery to the center of dialogue about [their] well-being" (Steger et al., 2021, p.3). These artefacts constitute a living 'dossier' that made participants' socio-emotional and civic outcomes visible and measurable.

Case Study 1: Fostering belonging in construction. This school-based intervention examined built environments as both technical processes and social sites that can include or exclude. Participants used 3D printing with clay and plastics to design a series of small houses, prompting reflection on questions of belonging in construction. Through creating models and drawing representations of builders (figure 1), learners considered how construction practices and spaces determine who is seen as part of the field. The latter constituted the case's final emotional cartography, making visible participants' reflections on inclusion and self-identification within construction.

Case Study 2: Redesigning makerspaces for inclusion. The second school-based intervention invited participants to redesign their school's makerspace to welcome groups often excluded from technical settings. Through the use of AI and craft materials, participants collaboratively reimagined the space's social and aesthetic features, with the models serving as part of the final emotional cartography (Figure 2). The intervention positioned students as ethical actors, capable of making changes in their local community, while the process itself made visible students' capacity to act inclusively and to show respect for difference and diversity.

Case study 3: E-textiles and AI: Stitching solutions. This out-of-school museum-based intervention invited participants to explore how technology can address social issues through the integration of AI, textiles, and circuitry (figure 3). Students were guided to create light-up patches to combine into a community quilt showing robots capable of solving social problems, such as helping elderly people and cleaning up the oceans. The patches were joined together to create this group's cartography. Learners practiced empathy, exercised ethical reasoning, and reflected on how technology can help to solve problems and serve different groups. Through AI as a co-creator, participants critically considered how AI can be an exclusionary technology when it produced faulty circuits.

Case Study 4: Inclusive spaces: Robotics with Lego. The fourth case, our second out-of-school workshop at the same museum, invited participants to use simple robotics and Lego systems to design inclusive and accessible robotics laboratories for underrepresented groups. Students co-created prototypes, which also served as the emotional cartography, using blocks and craft materials, aimed at improving community accessibility and equity (figure 4). The activity combined creation with ethical reflection, reinforcing ideas of empathy understanding as measurable learning outcomes.

Implications: Rather than treating the arts as enrichment, our intervention designs make it possible to research and value arts-based activities for civic learning in STEM settings, especially socio-emotional outcomes related to the concept of belonging. Our analysis of the outcomes will provide evidence of the value of these activities to inform practice and policy in arts-based education.

Figure 4
Constructing a Tiny House with Clay



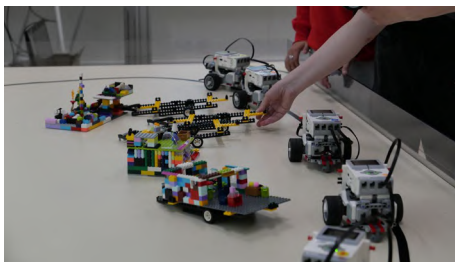
Figure 5
Final Makerspace Models



Figure 6
A 'Social Robot' with E-Textiles & AI



Figure 7
Designs for Inclusive Robotics Spaces



A holistic rationale for the arts through connected arts learning

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Context. Historically, arts education has been largely justified through two primary lenses. One considers the benefits of engaging with the arts for its own sake, meaning the value of arts learning is learning about art itself (Winner & Hetland, 2000). The second lens looks at how the arts contribute to learning in other academic areas, such as gains in reading or math (Guhn et al., 2020). While both lenses highlight important individual benefits, research indicates that arts education can be more broadly conceived of as influencing additional life and learning outcomes. These outcomes include engagement in the arts as influencing career trajectories (Catterall et al., 2009), civic engagement (Stevenson, 2011), and social-emotional well-being (Stuckey & Nobel, 2010). The arts can also contribute to community-level benefits such as civic participation and cross-cultural understanding (Catterall et al., 2009). Despite these documented impacts, traditional arguments for arts education often overlook the entirety of this evidence base. To address this gap, the Connected Arts Learning Framework (Peppler, Dahn, & Ito, 2022;

Peppler, Dahn & Ito, 2023) integrates the promise of arts education outcomes with principles from connected learning, emphasizing interest development, relationships, and opportunities that support holistic learning outcomes for individuals and communities. To develop the Connected Arts Learning Framework, we asked: “What if learning about or practicing the arts could help young people connect more directly to their communities and the world they live in? How might that change the experience both for young people and their communities? Our objective in developing the framework was to outline the different ways that arts education supported learning for young people.

Methods. Methods for the development of the Connected Arts Learning Framework included a literature review across arts education and relevant out-of-school time literature (Peppler, Dahn & Ito, 2022), and interviews with arts education leaders. We spoke with 13 leaders in arts education working in various settings, including staff in arts afterschool programs, academic professors, and working artists. We also engaged with five exemplar out-of-school time community arts organizations to support framework development.

Findings. Our research yielded five distinct approaches for connected arts learning. These approaches included: 1) Culturally sustaining arts: Puts a community’s culture at the center of arts experiences; 2) Future forward arts: Prepares youth for future workforce or civic participation; 3) Networked arts: Embeds art in networks including families, educators, and working artists; 4) Doing well by doing art: Supports participants’ health and well-being through art; and 5) Youth voice arts: Emphasizes youth perspectives, leadership, and activism. We found that community arts organizations working in ways that showcased connected arts learning often followed one or a combination of these five approaches. Five case studies of exemplar organizations offered specific texture to how each of these approaches is enacted in practice.

Implications. Implications of this work include broadening arguments for what counts in arts learning and supporting the development of research-practice partnerships to explore connected arts learning in communities. Our work in the development of the Connected Arts Learning Framework has also produced various tools to support Connected Arts Learning. These tools include a rubric, as well as guiding questions for organizations, educators, and community leaders to support development of and reflection on arts education programs.

References

- Barad, K. (2003). Posthumanist performativity: Toward an understanding of how matter comes to matter. *Signs*, 28(3), 801–831.
- Barad, K. (2017). What flashes up: Theological-political-scientific fragments. In C. Keller & M.-J. Rubenstein (Eds.), *Entangled Worlds: Religion, Science, and New Materialisms* (pp. 49-71), Fordham University Press.
- Benjamin, W. (1999). Doctrine of the similar (1933). In M. W. Jennings, H. Eiland, & G. Smith (Eds.), *Walter Benjamin: Selected writings*, Volume 2, 1927–1934 (pp. 694–698). Harvard University Press.
- Bennett, J. (2010). *Vibrant matter: A political ecology of things*. Duke University Press.
- Blikstein, P. (2013). Digital fabrication and ‘making’ in education: The democratization of invention. *FabLabs: Of Machines, Makers, and Inventors*, 4(1), 1-21.
- Catterall, J. S. (2009). *Doing well and doing good by doing art: The effects of education in the visual and performing arts on the achievements and values of young adults*. Imagination Group/I-Group Books.
- Chemi, T., & Du, X. (2022). Arts-based methods in education – A global perspective. In X. Du & T. Chemi (Eds.), *Arts-based methods in education around the world* (pp. 1–14). River Publishers & Taylor & Francis.
- Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin*, 143(1), 1–35. <https://doi.org/10.1037/bul0000052>
- Clapp, E. P., & Jimenez, R. L. (2016). Implementing STEAM in maker-centered learning. *Psychology of Aesthetics, Creativity, and the Arts*, 10(4), 481–491.
- Clarke-Midura, J., Poole, F., Pantic, K., Hamilton, M., Sun, C., & Allan, V. (2018). How near peer mentoring affects middle school mentees. SIGCSE 2018 - Proceedings of the 49th ACM Technical Symposium on Computer Science Education, 2018-January, 664–669. <https://doi.org/10.1145/3159450.3159525>
- Eisner, E. (2002). *The arts and the creation of mind*. Yale University Press.
- Fancourt, D., & Finn, S. (2019). What is the evidence on the role of the arts in improving health and well-being? A scoping review (*Health Evidence Network synthesis report No. 67*). Copenhagen: WHO Regional Office for Europe. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK553773/>
- Fleming, M., Bresler, L., and O’Toole, J. (Eds.). (2015). *The Routledge International Handbook of the Arts and Education*. New York, New York: Routledge

- Guhn, M., Emerson, S. D., & Gouzouasis, P. (2020). A population-level analysis of associations between school music participation and academic achievement. *Journal of Educational Psychology*, 112(2), 308–328. <https://doi.org/10.1037/edu0000376>
- Halverson, E. R., Saplan, K., & Martin, C. K. (2024). Building arts education policy using the tools of out-of-school-time youth arts organizations. *Arts Education Policy Review*, 125(4), 300–312. <https://doi.org/10.1080/10632913.2023.2212186>
- Halverson, E. R., Saplan, K., Mejias, S., & Martin, C. (2024). What we learn about learning from out-of-school time arts education. *Review of Research in Education*, 47(1), 360–404. <https://doi.org/10.3102/0091732X231223492>
- Halverson, E., & Sawyer, K. (2022). Learning in and through the arts. *Journal of the Learning Sciences*, 31(1), 1–13. <https://doi.org/10.1080/10508406.2022.2029127>
- Hmelo-Silver, C. E., & Barrows, H. S. (2008). Facilitating collaborative knowledge building. *Cognition and Instruction*, 26(1), 48–94. <https://doi.org/10.1080/07370000701798495>
- Jindal-Snape, D., Davies, D., Scott, R., Robb, A., Murray, C., & Harkins, C. (2018). Impact of arts participation on children's achievement: A systematic literature review. *Thinking Skills and Creativity*, 29, 59–70. <https://doi.org/10.1016/j.tsc.2018.06.003>
- Johnson, M. L. (2002). Vantage theory meets cognitive psychology: a synthesis with frame theory. *Language Sciences*, 24(5-6), 639–665.
- Kafai, Y. B., Fields, D. A., & Searle, K. A. (2014). Electronic textiles as disruptive designs: Supporting and challenging maker activities in schools. *Harvard Educational Review*, 84(4), 532–556.
- Knappett, C. (2008). The Neglected Networks of Material Agency: Artefacts, Pictures and Texts. In C. Knappett & L. Malafouris (Eds.), *Material Agency: Towards a Non-Anthropocentric Approach* (pp. 139–156). Springer US. https://doi.org/10.1007/978-0-387-74711-8_8
- Keune, A. (2024). Learning within fiber-crafted algorithms: Posthumanist perspectives for capturing human-material collaboration. *International Journal of Computer-Supported Collaborative Learning*, 19(1), 37–65.
- Latour, B. (1996). On actor-network theory, A few clarifications plus more than a few complications. *Soziale Welt*, 47, 369–381.
- Makkonen, T., & Inkinen, T. (2024). Inclusive smart cities? Technology-driven urban development and disabilities. *Cities*, 154, Article 105334. <https://doi.org/10.1016/j.cities.2024.105334>
- Mandoki, K. (2007). *Everyday aesthetics: Prosaics, the play of culture and social identities*. Ashgate.
- Mejias, S., Thompson, N., Sedas, R. M., Rosin, M., Soep, E., Peppler, K., ... & Bevan, B. (2021). The trouble with STEAM and why we use it anyway. *Science Education*, 105(2), 209–231.
- Misra, T., Barber, J., Manu, G., Malani, V., Kamak, M., Phalkey, J., & Barman, P. (2025). Weaving Science into Creative Writing: Integrating interdisciplinarity into young adult learning. *Southern African Journal of Environmental Education*, 42(1), 1–27
- Mowlah, A., Niblett, V., Blackburn, J., & Harris, M. (2014). *The value of arts and culture to people and society: An evidence review* [Report]. Arts Council England. <https://www.understandingsociety.ac.uk/research/publications/publication-522416>
- Noddings, N. (2013). *Caring: A relational approach to ethics and moral education* (2nd ed.). University of California Press.
- Peppler, K. A., Powell, C. W., Thompson, N., & Catterall, J. (2014). Positive Impact of Arts Integration on Student Academic Achievement in English Language Arts. *The Educational Forum*, 78(4), 364–377. <https://doi.org/10.1080/00131725.2014.941124>
- Peppler, K., & Wohlwend, K. (2018). Theorizing the nexus of STEAM practice. *Arts Education Policy Review*, 119(2), 88–99. <https://doi.org/10.1080/10632913.2017.1316331>
- Halverson, E., & Peppler, K. (2018). The Maker Movement and Learning. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.), *International Handbook of the Learning Sciences* (pp. 285–294). Routledge
- Paat, Y.-F., Garcia Tovar, D., Myers, N. W., Orezza, M. C. E., Giangiulio, A. M., Ruiz, S. L., Dorado, A. V., & Torres-Hostos, L. R. (2025). *Leveraging an arts-based approach to foster engagement, nurture kindness, and prevent violence*. *Behavioral Sciences*, 15(6), 799. <https://doi.org/10.3390/bs15060799>
- Pahl, K., & Rowsell, J. (2010). *Artifactual literacies: Every object tells a story*. Teachers College Press.
- Pahl, K., & Rowsell, J. (2011). Artifactual critical literacy: A new perspective for literacy education. *Berkeley Review of Education*, 2(2), 129–151.
- Papert, S. (1996). *The connected family: Bridging the digital generation gap*. Longstreet Press.

- Papert, S., & Harel, I. (1991). Situating constructionism. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 1-11). Ablex Publishing.
- Peppler, K., Dahn, M., & Ito, M. (2022). Connected arts learning: Cultivating equity through connected and creative educational experiences. *Review of Research in Education*, 46(1), 264-287. <https://doi.org/10.3102/0091732X221084322>
- Peppler, K., Dahn, M., & Ito, M. (2023). *The Connected Arts Learning Framework: An expanded view of the purposes and possibilities for arts learning*. The Wallace Foundation. <https://doi.org/10.3102/0091732X221084322>
- Pickering, A. (1993). The mangle of practice: Agency and emergence in the sociology of science. *American Journal of Sociology*, 99(3), 559-589.
- Prezioso, E., & Alessandrini, N. (2023). Enacting memories through and with things. *Memory Studies*, 16(4), 962-983.
- Rautio, P. (2013). Children who carry stones in their pockets. *Children's Geographies*, 11(4), 394-408.
- Ross, C. H., & Fried, S. J. (2022). For the public good: Incorporating civic science into undergraduate STEM education. *Journal of Science Policy & Governance*, 20(02). <https://doi.org/10.38126/JSPG200207>
- Saito, Y. (2007). *Everyday aesthetics*. Oxford University Press.
- Saito, Y. (2017). *Aesthetics of the familiar: Everyday life and world-making*. Oxford University Press.
- Segev, Y., Kashi, S., & Hod, Y. (2025). Insights from expert maker teachers' embodied learning designs. In *Proceedings of the 19th International Conference of the Learning Sciences-ICLS 2025* (pp. 1510-1514). International Society of the Learning Sciences.
- Steger, A., Evans, E., & Wee, B. (2021). *Emotional cartography as a window into children's well-being: Visualizing the felt geographies of place*. *Emotion, Space and Society*, 39, 100772. <https://doi.org/10.1016/j.emospa.2021.100772>
- Stevenson, L. M. (2011). *Creating destiny: Youth, arts, and social change*. [Unpublished doctoral dissertation]. Stanford University. <http://purl.stanford.edu/bf113xh2911>
- Thompson, N., DiCioccio, M., Barber, J., & Graham, G. (2025). "CO2 Was a Wanderer": Interdisciplinary Imaginings in a Teen Science-Based Creative Writing Workshop. In *Proceedings of the 19th International Conference of the Learning Sciences-ICLS 2025*, pp. 314-322. International Society of the Learning Sciences.
- UNESCO. (2015). *Global citizenship education: Topics and learning objectives*. UNESCO. <https://doi.org/10.54675/DRHC3544>
- Vadeboncoeur, J. A., Perone, A., & Panina-Beard, N. (2017). Creativity as a practice of freedom: Imaginative play, moral imagination, and the production of culture. In V. P. Glăveanu (Ed.), *The Palgrave handbook of creativity and culture research* (pp. 285-303). Palgrave Macmillan. https://doi.org/10.1057/978-1-137-46344-9_14
- Venkatesh, V., Ruprecht, L., & Ferede, M. K. (2023). *Arts education: An investment in quality learning*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000386034>
- Venturini, T., Jacomy, M., & Jensen, P. (2021). What do we see when we look at networks: Visual network analysis, relational ambiguity, and force-directed layouts. *Big Data & Society*, 8(1). <https://doi.org/10.1177/20539517211018488> (Original work published 2021)
- Vossoughi, S., Escudé, M., Kong, F., & Hooper, P. (2013). Tinkering, learning & equity in the after-school setting. In *Proceedings of the 10th International Conference on Computer Supported Collaborative Learning*.
- Winner, E., & Hetland, L. (2000). The arts in education: Evaluating the evidence for a causal link. *Journal of Aesthetic Education*, 34(3/4), 3-10.
- Wright, S. (2012). Ways of knowing in the arts. In S. Wright (Ed.), *Children, meaning-making and the arts* (2nd ed., pp. 1-29). Pearson Higher Education.

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