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Centering Art Practices: A Narrative Inquiry Into Elementary Teachers' STEAM Integration

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Abstract

This article explores the pedagogical orientations of four K-5 teachers who participated in four years of monthly STEAM professional development involving STEM-based artmaking and emergent curriculum design with professional artists. This narrative inquiry captures how the teachers made meaning of their experiences. Interviews were analyzed and focused on turning points concerning instructional practices, integrating the arts, and disciplinary boundaries. Each of the teachers' STEAM practices involved idea-driven inquiry, material exploration, creative interpretation, and the use of physical space. These contemporary arts practices helped the STEAM Ahead students make "personally relevant connections between materials, design, society and the natural environment" (Sochacka et al., 2016, p. 15). These practices also shifted classrooms toward a physical and relational setting more conducive to collaboration and creative production. By foregrounding the arts in STEAM learning, we invite future directions for transforming pedagogical practices that expand disciplinary knowledge and boundaries through artistic ways of knowing.

Introduction

Integrating STEAM disciplines is a complex endeavor. Each discipline has distinctive theoretical underpinnings and practices that potentially create boundaries impacting integration (Tytler & Swanson, 2021). There is no consensus in the literature on the definition of the "A", and the arts tend to be in service of STEM content areas (Boice et al., 2021; Halverson & Sawyer, 2022; Perignat & Katz-Buonincontro, 2019; Sochacka et al., 2016). However, we are using Katz-Buonicontro's definition of STEAM "as the integration of the arts disciplines into curriculum and instruction in the areas of science, technology, engineering, and mathematics" (p. 73), because it aligns with our aim to conceptualize the arts as the vehicle for guiding transdisciplinary inquiry. Our research explored how the arts became central to transdisciplinary inquiry in elementary STEAM classrooms and led to teachers permeating disciplinary boundaries.

We examined teacher strategies for integrating STEAM using Contemporary Arts Practices (CAP) (Smolin, 2010) within a multiyear collaborative project between teachers and artists called STEAM Ahead. Through four years of monthly professional development, kindergarten through 5th grade teachers engaged in collaborative artmaking and emergent curriculum design with professional artists. This article will contribute a nuanced discussion of turning points for arts-driven STEAM curriculum and transforming pedagogical practices that expand disciplinary boundaries through artistic ways of knowing.

Background and Context

STEAM Ahead, funded by the U.S. Department of Education's AAEDD Grant Program, aimed to enhance arts education for kindergarten through 5th-grade students in a suburban public elementary school district by integrating arts into STEM content. Partnering with Chicago Arts Partnerships in Education (CAPE), the initiative involved arts, STEAM, and grade-level teachers from five public elementary schools. Teaching artists collaborated with designated Core STEAM AHEAD educators to develop and implement arts-integrated curricula that incorporated Crosscutting Concepts from the Next Generation Science Standards (NGSS). This narrative inquiry drew upon projects from the program year that focused on thematic exploration of environmental issues for curriculum design. Within the STEAM Ahead professional and curriculum development framework, the NGSS Crosscutting Concepts were used to bridge STEM and artistic inquiry practices and artmaking. For example, concepts like "patterns" or "cause and effect" were used to understand environmental issues with a scientific understanding while also supporting conceptual exploration by repurposing or reclaiming waste materials in artmaking. To this end, Crosscutting Concepts were used as integrative tools to connect big ideas across the disciplines and support student engagement in

interdisciplinary practices. Projects spanned art forms and academic content, fostering inquiry and creative processes. Monthly professional development sessions supported teachers in arts integration and collaborative curriculum design.

Artists with robust studio, performance, socially engaged, and/or community-based arts practices brought unique perspectives to classrooms. With a history of partnering contemporary artists with classroom teachers, CAPE integrates Contemporary Arts Practices (CAP) into professional development and collaborative curriculum design. CAP guided the transformation of instructional practices, promoting student engagement in conceptually rich artistic processes and contemporary cultural conversations (Gude, 2013). CAP-integrated classrooms reflect communities of practice (Wenger, 1998), where teachers, teaching artists, and students work as Artist/Researchers to shift classroom norms toward a physical and relational setting more conducive to collaboration and creative production (Calweti et al., 2024). CAPE's expertise in arts integration and CAP laid the groundwork for STEAM Ahead, broadening the scope of what the "A" represents in STEAM.

Literature Review

The literature on STEAM reflects a complexity that has been present from its inception, distinctive theoretical underpinnings within each discipline (Tytler & Swanson, 2021), and a lack of consensus on the role of art in STEM learning (Boice et al., 2021; Halverson & Sawyer, 2022; Perignat & Katz-Buonincontro, 2019; Sochacka et al., 2016). The following section will describe 1) the theoretical underpinnings of STEAM approaches, 2) boundaries for integration, and 3) how the arts have been positioned within STEAM.

Theoretical Underpinnings of STEAM

A central challenge to STEAM has been the depth of theoretical integration across disciplines (Bevan et al., 2019) and the arts have been poorly defined. Due to STEAM being an evolution of STEM practices, some scholars have defined a goal toward co-equal focus of STEM and the arts (Boice et al., 2021; Halverson & Sawyer, 2022). A co-equal focus can support bolstering the arts to be mutually complementary rather than subservient to STEM disciplines (Halverson & Sawyer, 2022). However, theorizing the integration of arts in STEAM can be a challenge, especially for non-arts educators (Perignat & Katz-Buonincontro, 2019). When art practices are not well understood, they can be relegated to a decorative component (Bevan et al., 2019), “just an activity ‘pasted on’ at the end of the lesson” (Hardiman & JohnBull, 2020, p. 7), or otherwise inauthentically integrated (Sanz-Camarero et al., 2023). When transdisciplinary approaches push the boundaries of what it means to learn within a particular discipline, it can help facilitate opening up students from “specific

identities of the 'artsy' or 'mathsy' person" (Bevan et al., 2019, p. 25). For example, a limited form of integration may involve a decorative element (Bevan et al., 2019), whereas in a transdisciplinary approach "students engrossed in the sciences can learn the value of thinking like an artist when working through complex problems. Students in the arts can realize how their unique way of 'knowing' can contribute to scientific results" (Haroutounian, 2020, p. 170). The goal of the latter form of integration is to disrupt boundaries altogether (Mejias et al., 2021) by expanding ways of knowing and producing knowledge (Bevan et al., 2019).

There is a discrepancy between superficial or traditional theorizations of the arts and the conceptually rich possibilities of CAP in STEAM contexts. Who is involved in professional development, curriculum planning, and implementation also has an impact on theoretical depth across STEAM disciplines. Most in-school STEAM models involve a classroom teacher, sometimes collaborating with another STEM or art teacher in the school. Beyond this STEAM Ahead project, we found one in-school program that incorporated arts expertise from outside of the school. In a year-long professional development program, STEAM Journey involved collaboration between a STEM teacher and arts teacher along with "a creative innovator-in-residence" to support arts integration (Boice, et al., 2021). This highlights the underexplored opportunity for outside art experts to help teachers' ability to theorize the role of art in STEAM.

Boundaries for Integration: What Does Integration Even Mean?

Boundaries for STEAM integration are based on how the relationships between disciplinary content are conceived and the pedagogy employed. STEAM is an approach that transforms the design of STEM curriculum and how it is taught through the integration of the arts (Katz-Buonincontro, 2018). Taking this definition, STEAM itself is a transdisciplinary pedagogical approach that should transform not only the curricular content, but pedagogy through art practices (Boice et al., 2021; Katz-Buonincontro, 2018; Mejias et al., 2021; Perignat & Katz-Buonincontro, 2019). Creative thinking and problem solving are both a STEAM goal and rationale for integrating the arts (Halverson & Sawyer, 2022; Hardiman & JohnBull, 2020; Haroutounian, 2020; Guyotte et al., 2015; Katz-Buonincontro, 2018; Perignat & Katz-Buonincontro, 2019). However, a critique of instruction for both STEAM and creativity is a focus on the what of activities rather than the how of implementation (Boice et al., 2021; Perignat & Katz-Buonincontro, 2019). This challenge requires support in professional development, because "many educators struggle to understand that creativity development is fostered, not through the art materials or products, but through a process of exploration, play, risk-taking, making mistakes, self-evaluation and feedback" (Perignat & Katz-Buonincontro, 2019, p. 41). Although creative thinking is often attributed to the arts, several authors challenged the assumption that STEM disciplines do not involve creativity (Mejias et al., 2021; Sochacka et al., 2016), and others drew specific parallels between artistic and scientific

processes because both involve purposeful inquiry (Bevan et al., 2019; Haroutounian, 2020; Mejias et al., 2021). Process oriented pedagogical approaches (e.g. project, problem, and inquiry based learning) are common in STEAM because they are designed to support student-driven exploration and crossing disciplinary bounds (Boice et al., 2021; Herro & Quigley, 2020; Perignat & Katz-Buonincontro, 2019). In project or problem-based learning, boundaries between disciplines are crossed as students explore an inquiry area or authentic scenario (Boice et al., 2021). STEAM involves pedagogical change by using arts to drive transdisciplinary inquiry through creative and open-ended, process-oriented learning.

The "A" in STEAM

There is not one definition or purpose for the "A" in STEAM, but art has been positioned as instrumental to improving performance in STEM disciplines through the process, products, and materials involved (Boice et al., 2021; Mejias et al., 2021; Perignat & Katz-Buonincontro, 2019; Sochacka et al., 2016). Artistic processes expand the way students think about and perceive materials. They can also deepen STEM learning beyond the cognitive to embrace expression, socio-cultural contexts, and a wider range of sensorial knowledge (Haroutounian, 2020; Katz-Buonincontro, 2018; Sochacka et al., 2016). Teachers and students can "explore personally relevant connections between materials, design, society, and the natural environment and to critically engage with implicit and explicit facets of disciplinary identity" (Sochacka et al., 2016, p. 15). By using art practices to open up inquiry into the local or personal context, students can establish critical connections between themselves and the content. For example, "bringing critique to science learning promises to open a door not only onto 'what constitutes the best evidence' as described by the NRC (2012b), but also to the possibilities for developing a critical stance toward the culture of science and its history of power" (Bevan et al., 2019, p. 33). Opening up the curriculum in this way invites "multiple ways to think about, and demonstrate, content and concepts" (Hardiman & JohnBull, 2020, p. 6), and creates conceptual and physical space "for transformation and student directed learning" (Boice et al., 2021). The product of a STEAM project also changes through art practices, because artistic inquiry foregrounds "key concerns" rather than a solution (Bevan et al., 2019, p. 25), and the product could be an exhibition or performance (Boice et al., 2021; Haroutounian, 2020). The role of arts in STEAM is to generate more personal, open-ended inquiry that expands ways of knowing across disciplinary boundaries.

Our review of the literature suggests that teachers need support to theorize conceptually rich understandings of transdisciplinary approaches to STEAM (Bevan et al., 2019; Hardiman & JohnBull, 2020; Perignat & Katz-Buonincontro, 2019) and the role of art practices in facilitating integrated learning processes (Bevan et al., 2019; Boice et al., 2021; Perignat & Katz-Buonincontro, 2019). Specifically, artistic ways of knowing can contribute to 1) expanding knowledge (Bevan et al., 2019; Hardiman & JohnBull, 2020; Tytler & Swanson,

2021), 2) disrupting disciplinary boundaries, and 3) deepening student engagement through personally relevant socio-cultural connections (Bevan et al., 2019; Sochacka et al., 2016). Non-art teachers need support for integration to move beyond superficial activities to conceptualize how the arts can transform pedagogical approaches (Perignat & Katz-Buonincontro, 2019).

Because many articles lack rich descriptions or involve more traditional forms of artistic production (e.g. symbolic representation or formulaic making processes), we propose that CAP can contribute to the field by clarifying the role of art on inquiry and conceptual engagement with materials and ideas. In our review, we found arguments that art practices can drive pedagogical change through creative, open-ended inquiry processes and expand what knowledge counts across disciplines (Bevan et al., 2019; Hardiman & JohnBull, 2020; Tytler & Swanson, 2021). Haroutounian (2020) suggested STEAM may be a ripe area to better understand "how artistic ways of knowing play a part in the creative process for artist/student interdisciplinary experiences" (p. 172). We believe that the promise of "A" in STEAM is in expanding ways of knowing and learning in classrooms, and that transformations must start with a better understanding of how teachers experience pedagogical changes related to STEAM integration. Taken together, we seek to understand the turning points in pedagogical orientations of individual elementary STEAM teachers through narrative explorations.

Materials and Methods

Drawing on interview data from three grades K-3 STEAM teachers and one 4th and 5th grade Art teacher, we explored how our participants reconstructed their experiences and made meaning of them (Dewey, 1938). Our semi-structured interview protocol included open-ended questions stemming from interviewees' responses, covering topics such as contemporary arts practices, interdisciplinary teaching, student inquiry strategies, and examination of curriculum artifacts like lesson plans, implementation videos, student drawings, assemblages, and classroom installations. All interviews were recorded, transcribed, and analyzed using open coding to identify themes. Narrative accounts were then developed to capture these themes, providing insights into how teachers' pedagogical orientations evolved as they centered the arts into the STEAM Ahead curriculum. We employed narrative inquiry as our methodology to construct an "interpretive space" (Barone, 2001, p. 150) with participants across professional development and classroom settings (Kim & Latta, 2010). This framework allowed participants to revisit and reinterpret their experiences, deepening their understanding of their learning through the STEAM Ahead project.

Our analysis explored pivotal moments, or turning points, in the pedagogical shifts of these teachers. Turning points are significant events that can lead to transformative change (Denzin, 1989, p. 23). We investigated how professional development and collaboration with

teaching artists prompted these turning points, influencing instructional practices and strategies for integrating the arts to disrupt disciplinary boundaries. Through interviews, teachers reflected on their instructional narratives and the role of the arts in their curriculum. Table 1 displays background information on the four teachers in this narrative inquiry, their grade levels, and a brief description of their project.

Table 1

Teacher backgrounds and project information

Teacher	Grades	Project
Ellen	STEAM K-3	Habitats: Oceans Plastics in the Ocean: Repurposing plastics as art objects
Anna	STEAM K-3	Habitat: Local environment Waste issues: Exploring waste at a school-level and designing solutions
Linnie	STEAM Ahead K-3	Habitats: Oceans Reimagining Waste: Using reclaimed and found materials to build an underground machine rather than disposing of waste in the ocean.
Fern	Art: 4-5	Habitat: Local environment Transformation: How can we reimagine and redesign the spaces around us?

Results: Turning Points for Teachers

The following narratives illuminate teachers' pedagogical turning points and the transformative interdisciplinary practices that they developed through their evolving artistic

ways of knowing.

Ellen: Broadening the Disciplines

Ellen was a STEAM teacher working with K-3 students during STEAM Ahead. Ellen explored the connections between artistic practices and research, discovering how students' engagement with a big idea can be enhanced through their material exploration. She described CAP in STEAM as an open-ended exploration of materials for purposes such as "engineering" a final product. Rather than teaching isolated art skills or art mediums, instruction is driven by a big idea. Many subject areas are integrated. As students learned with materials, they assumed the role of researchers where imaginative exploration led to novel uses of materials, integrating art, science, and engineering into their discoveries.

Through the STEAM Ahead program, Ellen's STEAM practices evolved. The conceptual approach of CAP made the STEAM Ahead curriculum more interdisciplinary and expansive, extending beyond just science. Additionally, activities that were previously play-based with only loose connections to content became more directly aligned with grade-level academic standards. Ellen provided the following curriculum example of this conceptual approach:

> We're learning about plastics in the ocean this year. They were engineering plastic masses. Now they create a blueprint, they decide what materials they're going to use to put their plastic mass together, they draw a picture of the plastic mass, they create the plastic mass. And this is one group of kids while other kids are painting their ocean animal, and other kids are using recyclables and art crafty materials to create their ocean animals, and other kids are maybe reading a book and writing sticky notes about what they're learning about ocean animals, so that's all going on at once. And all of the activities are just more directly tied to having kids show what they're learning as opposed to just experimenting with something in the moment.

Through CAP, the integration of simultaneous activities encouraged Ellen's students to follow their own paths to understanding plastics and the oceans, whether it be engineering and design, art and creativity, or reading and reflection. CAP promoted deeper student engagement through material exploration across STEAM disciplines. It invited learners to ask questions and pose problems such as: "How can I assemble different materials together to make some type of artistic creation or product? How can I manipulate these materials to make explicit hidden meanings and engage audiences?" (Smolin, 2019).

These questions helped transform Ellen's classroom space from rows of desks to a layered ocean:

> Instead of having just one word wall, our words and definitions and pictures are all interspersed around the room. Our centerpiece has layers of the ocean in it, and as the students make their animals of the ocean we put them in the appropriate layer so it reinforces their learning and their art becomes part of that décor. The fish is bioluminescent, like maybe using aluminum foil on the fish in order to make it look like it's glowing. So the students are invited to not only research in books, but research with materials, potentially asking questions such as "what material would help others to think that my fish is glowing?"

Ellen experienced several turning points that changed the nature of her STEAM teaching. Her instruction became increasingly interdisciplinary and conceptual. Students were given more pathways to how they explored and researched the relationship between waste and oceans, as well as how to use materials to convey their understanding. In the process, Ellen learned to use her classroom as a resource: material for creating a dynamic, interactive space, resembling a vibrant ocean.

Anna: Idea Driven Instruction

Anna was a K-3 STEAM teacher during STEAM Ahead, with fourteen years of experience as a Kindergarten teacher. Her classroom reflected a blend of both roles. For example, the physical setup of Anna's classroom allowed students to engage with content areas and foundational skills like reading and writing through hands-on material exploration. It featured flexible seating for group work and teacher demonstrations, and various areas designed to spark curiosity and encourage exploration. These spaces support both spontaneous and planned investigations, leading to longer-term projects.

Anna was hesitant to take on the STEAM position: "When I was asked to do the STEAM position it was like, 'Well, I don't know anything besides kindergarten.' And then I took that risk." Anna faced several turning points as she transitioned into her new role. Initially, she struggled with integrating STEAM into her teaching while also adapting to different grade levels. Moreover, she had to adjust from her previous STEAM practices to align with the new STEAM Ahead approach: "In the beginning, the children all had to be doing the same kind of stuff. We started with STEAM in a certain way, and it was almost more simplistic." Through her sustained engagement in the STEAM Ahead professional development program, Anna evolved beyond her previous practices.

Anna discussed a curriculum example aimed at addressing the waste generated from classroom materials and supplies, starting with students investigating the types of waste they observed during the school day. This "idea-driven" approach used the local environment as a source of inquiry, rather than relying on traditional didactic instruction

or separating science from everyday experiences. Inquiry became a joint endeavor between Anna and her students through questions and discussing ideas:

> 'How can we fix this? How can we make this better?' And then we cleaned up the trash. And so giving them a problem, how can we make this better, then having a recycling bin in our room. Through questions, the students are encouraged to problem solve and to be a part of the solution.

While Anna encouraged her students to raise questions, she didn't offer answers: "If a child comes up to me and asks me a question, I don't give them the answer. They have to find that solution. And talk it out, obviously." This marked a turning point in Anna's teaching approach, influenced by CAP, her teaching became more idea-driven, fostering co-inquiry and expanding possibilities for both she and her students. These qualities helped Anna to "let go" over her control of her classroom structure, and in so doing "let myself let them go." She then began to see *what* her students were learning and *how* they learned, developing a better sense of her students: "I have learned, me a 40-year-old, has learned just as much as the kids in teaching them." She gained confidence in their abilities and experimented with a pedagogy of student agency: "In STEAM Ahead they take what they learn from me and that's how they choose what they want. THEY choose. The students get to work at the same time in different ways." Another important aspect was letting go by not intervening even when Anna thought that their choices were inefficient or wrong: "And not telling them that that's the wrong choice, or like "Oh no, but it would be made better like this." Anna recognized the importance of student autonomy and the benefits of not imposing her own opinions on her students: "It's amazing what they end up coming up with. The students get to explore and they end up liking it a whole lot more than what I observed before."

As Anna grew through the STEAM Ahead program, her pedagogy shifted from being teacher-directed to embrace student-led inquiry. Anna supported her students as they found solutions through dialogue and experimentation. By implementing "idea-driven instruction," she and her students co-constructed learning experiences that involved exploration of materials and the integration of arts within STEAM.

Linnie: Taking Risks

Linnie is a veteran teacher who served as a Kindergarten teacher while participating in the STEAM Ahead program. She and her students undertook a STEAM recycling project where they used reclaimed and found materials to build an underground machine. The project involved reimagining waste, with their inquiry: "How can our explorations of waste lead to functional or artistic uses beyond throwing them in the water?"

In Linnie's classroom, the creative process began with the students' own ideas: "When you ask them to build something out of random material and they have to use their own thinking or imagination to do it because there's not a picture… they have to decide how to do it." However, as Linnie developed her approach to art within a STEAM context, she struggled to let go of her assumptions about her students' artistic abilities. Her teaching artist helped broaden her perspectives because:

> He thinks much differently than I do. He's a much more abstract thinker than I am, and so I'm trying to see his perspective… some of the things that he's tried with kids I would never have tried.

Through their collaboration, he inspired Linnie and illustrated how CAP opens students up to new possibilities for making meaning.

Linnie organized her room so that the students chose what they wanted to do. She shared that this arrangement led to students taking risks*:*

> Even if they're not good at it, they get to explore and maybe find out that they are good at something that they thought they weren't… didn't have that creativeness about them. Sometimes, the students selected what they believed they were good at.

Therefore, freedom and choice led some students to push at their self-imposed boundaries and step outside of their comfort zones even in areas where they initially lacked confidence or skill. Linnie continued:

> We do this blueprint, and they're like 'I don't know how to do that.' I go 'You'll be amazed.' And then when they're finished, they show it to you and they go 'Oh, I did it.' So that drawing component, when they're working on those fine motor skills and they say 'I can't do it,' and then to see that they were able to do it. Students were discovering their hidden talents and abilities they didn't realize they had.

Venturing beyond their self-imposed limits, students delved into new disciplines and art practices, allowing them to explore their own ideas creatively.

In summary, Linnie's exposure to her teaching artist's abstract thinking and innovative approaches challenged her previous assumptions about her students' artistic capabilities. By integrating student preferences and skills into her STEAM framework, Linnie allowed

students to explore materials and methods that interested them. This autonomy helped students push beyond their self-imposed limits and step out of their comfort zones, creating products they initially thought were beyond their capabilities. This flexibility as well as a softening of disciplinary boundaries enhanced the students' abilities to innovate by combining ideas from multiple disciplines.

Fern: What does an integrated curriculum even mean?

Fern, a 4th and 5th grade visual arts teacher, worked with all the students in her school. Her "school studio" space featured long tables arranged around the room, ample storage for art supplies, displays of student artwork, and bright lighting.

Fern shared that prior to STEAM Ahead, art was not really considered part of STEM. Fern's previous efforts to work within a STEAM framework were constrained by a lack of formal professional development (PD) and insufficient examples:

> I never had any training in problem-based learning. People would say 'Oh, it'll be a good idea to open up with a big idea.' But what does that mean? Where do I find this big idea? How do I incorporate that in art? So I didn't know how to do all those things before all the PDs. It's one thing when an administrator or a non-artist is telling you incorporate this in your practice for interdisciplinary, but you're like 'Well, give me an example,' but they can't.

Learning with colleagues in STEAM Ahead PD sessions, Fern theorized how artistic inquiry fosters STEAM learning. As a result, her natural teaching instincts became more finely tuned so that she and her students could explore big ideas, connect topics across disciplines, and shape inquiries through reflection.

Fern shared how the STEAM Ahead program re-shaped her teaching. Rather than teaching a specific media, her STEAM Ahead units started with a "big idea" to link art processes to another content area. This conceptual approach began with a key word and then evolved through discussion. For example, in one curriculum unit the word was "transformation" and proceeded as such: "We talked about what transformation is. Students gave examples like water transforms into ice, and water in its liquid state can transform into gas. So, we talked about change like that." Fern and her students identified relevant vocabulary and inquiry questions related to this concept of transformation, then brainstormed applications to their daily lives: "We made it more specific into like, 'how can we transform the space around us?' or 'how can students transform materials?'" These conversations helped Fern and her students create personally meaningful connections to the concept of transformation within their classroom, the broader school environment, and other disciplines.

Fern knew these disciplinary crossings were significant and believed it was important to build upon her students' comments. Therefore, she scaffolded their ideas to expand the classroom discourse. She defined this as a pedagogy of "opening things up":

> We open it up into like a bigger thing, so the science is there. What's another transformation in terms of like math. Some kids talked about fractions, how you can transform them so that they're smaller. It's the same thing, just a different form. I try to just connect it… I don't start with the artistic sense of it first. I ask them open-ended questions.

Fern described the students' transdisciplinary discourse as "common thinking" or "common sense thinking" that then provided a framework for exploring materials. For example, students explored plastic shopping bags, asking "How can we transform this material?":

> Even before we told them what we were going to do we were asking them questions. We were just posing it, and we told the students there were no right or wrong questions, we just want to investigate with the students and see what they can think of.

This holistic approach allowed students to apply concepts from various subjects—such as art, science, and mathematics—when engaging with materials. As a result, they were able to explore through a more comprehensive perspective, connecting ideas across different areas of study due to her distinctive CAP pedagogy.

Summary of Narratives

Table 2 displays themes that emerged across the teacher's narrative accounts. This data illustrates that there is not one linear path to conceptualizing STEAM and the role of arts.

Table 2

Themes across teacher narratives

Theme with Definition	Narrative Example
Contemporary Art Practices: Idea driven inquiry guiding emergent curriculum and artmaking. Curriculum inquiries are conceptual and examine problems/issues related to contemporary life	*How can our explorations of waste lead to functional or artistic uses beyond throwing them in the water?* (Linnie).
Expanding Material Exploration: The curriculum supports students' open-ended exploration of materials (including traditional media and space such as classrooms and hallways) that are incorporated conceptually or as a site for the purpose of artmaking	*Instead of having just one word wall, our words and definitions and pictures are all interspersed around the room. Our centerpiece has layers of the ocean in it, and as the students make their animals of the ocean we put them in the appropriate layer so it reinforces their learning and their art becomes part of that décor* (Ellen).
Broadening Interdisciplinary Curriculum: Academic disciplines become broadened and more inclusive, facilitating interdisciplinarity by permeating disciplinary boundaries while increasing depth of content.	*We open it up into like a bigger thing, you know, so the science is there. What's another transformation in terms of like math. Some kids talked about fractions. just open it up so that the students aren't confined to an art environment… I always open it up to a broader thing* (Fern).
Student Agency: Students choose materials to explore, how and what artistic products to create, and the messages they wish to convey through their artmaking.	*When you ask them to build something out of random material and they have to use their own thinking or imagination to do it because there's not a picture… they have to decide how to do it* (Linnie).

Teachers Taking Risks: Teachers learn to "let go" of didactic instruction taking on a more dialogic and co-learning interchange with their students.	*He's (Teaching Artist) a much more abstract thinker than I am, and so I'm trying to see his perspective… like some of the things that he's tried with kids I would never have tried* (Linnie).

The themes in Table 2 reveal that CAP and expanded material engagement drove student-led inquiry in ways that facilitated crossing disciplinary boundaries and teachers to surpass their own comfort zones. Prior to the STEAM Ahead project, the teachers held long standing assumptions about their teaching practices. These included what counts as content knowledge, the direction that their students needed in order to purposefully engage in curriculum activities, what materials are educational, and finally the prescribed ways that materials should be incorporated into the curriculum. As teachers took up CAP with collaborating teaching artists, inquiry reflected students' own personal worlds and concerns, enabling exploration across disciplines while connecting with each other and the proximal space. As such, the STEAM Ahead teachers transformed their instructional relationships with their students as they took a great risk and loosened their hold on curriculum talk. Classroom discourse became dialogic as the balance between talking and listening shifted, with teachers doing more listening and students more talking. In the process, teachers' assumptions about what vocabulary or ideas a kindergartner or first grader was capable of understanding were challenged, and they greatly expanded their notions about their students' capabilities. Each of the themes depicted in the above table fostered these teachers' turning points in integrating STEAM, transforming their instructional practices, increasing student agency and cultivating their greater understanding of the alternative ways of knowing that the arts can foster.

Discussion

These narratives provided rich examples of the ways in which teachers integrated contemporary arts practices within their STEAM curriculum. This was made possible through the teachers' collaborative co-teaching with teaching artists who have established contemporary arts practices. These findings offer a compelling invitation for further research into how partnering teachers and artists in professional development can support key challenges in STEAM of increased workload, support for collaboration, and theorizing integration (Boice et al., 2021). Through professional development and collaborative curriculum design, the arts became centered within an inquiry process incorporated across the STEAM disciplines. Specifically, the STEAM Ahead teachers experienced turning points in the following areas: theorizing about inter/transdisciplinary arts-infused practices, transforming those into pedagogical practices, and locating the "A" in STEAM.

Non-arts educators are challenged to theorize the arts in STEAM curriculum and

pedagogical approaches (Perignat & Katz-Buonincontro, 2019). STEAM Ahead teachers' abilities to do so developed in tandem with their confidence in facilitating student-led inquiry and material exploration. In unique ways, each teacher facilitated their students' conceptual engagement with materials and ideas, articulating connections between the arts and other areas of study. This meant that for all curriculum units, instruction became idea-driven rather than focused on isolated art skills, mediums, and specific content areas. For example in Linnie's project, student inquiry moved beyond science to ecology and the repurposing of waste in their own lives through an immersive classroom. This approach equipped students with "tools to understand and participate in contemporary cultural conversations" (Gude, 2013, p. 8), prompting fundamental questions that shape curriculum, redefine roles, and transform learning activities (Sikkema, 2016).

Being able to take theoretical ideas and transform them into practice was a turning point for teachers. As a result, teachers engaged their classrooms in conceptually rich artistic processes and expanded the materials and products that were part of inquiries. Students had the agency to learn with the materials of their choice and show what they were learning within a transdisciplinary framework rather than just complete a "discrete art activity" or create the same products. In these classrooms, teachers facilitated more deliberate and deeper connections between materials and content through the exploration of student-driven ideas that leveraged their lived experiences and interests as resources. The pedagogical transformations in the narratives capture how more exploratory and open-ended learning processes support creativity (Perignat & Katz-Buonincontro, 2019) student agency, and meaningful integration of the arts into STEAM. These examples provide valuable and varied details about what meaningful arts integration can look like, which has been a challenge in the field (Boice et al., 2021; Hardiman & JohnBull, 2020; Mejias et al., 2021; Perignat & Katz-Buonincontro, 2019; Sochacka et al., 2016).

Through class discussion and dialog, new ideas were generated and open-ended exploration with materials was fostered, leading everyone involved to permeate fixed disciplinary boundaries. In STEAM Ahead, artistic processes, rather than teacher direction, were foregrounded and students' inquiries explored problems as opposed to offering solutions. STEAM Ahead teachers facilitated contemporary art processes and production to guide students in questioning, engaging in critical conversations, and making a statement that invited others to critique with them. These are all attributes that CAP affords.

Additionally, through the STEAM Ahead, "artistic ways of knowing" (Haroutounian, 2020, p. 172) expanded pathways for students and teachers to employ inquiry to understand content across disciplinary boundaries. Each STEAM Ahead teacher found the "A" within the artistic practices of: 1) research and exploration of materials, 2) creative interpretation, 3) the use of

physical space as an artistic component, and 4) critique. These practices emerged as a turning point in how CAP was enacted in STEAM Ahead as part of authentic disciplinary practices. In Anna's STEAM project, waste was made a locally contextualized inquiry that drew personal connections between students, content, and their school space. The students developed perceptual awareness through artistic ways of knowing (Haroutounian, 2020), because as they investigated how to solve a waste problem they became more attuned to noticing waste in how the school and society manage it. In Ellen's project, students used artistic ways of knowing to explore and represent with materials that spanned sensory, cognitive, and expressive realms (Haroutounian, 2020). For example, as students created a lanternfish they acquired scientific knowledge, accessed their sensory perception, and enacted creative expression to learn about bioluminescence. Lastly, physical space became a resource to actively learn with as part of CAP (Boice et al., 2021). Ellen transformed her classroom into an immersive ocean environment that students contributed to through vocabulary and artistic creations that became a collective resource. These contemporary arts practices helped the STEAM Ahead students to make "personally relevant connections between materials, design, society, and the natural environment" (Sochacka et al., 2016, p. 15), as exemplified in the narratives.

By theorizing, transforming and locating the "A" within STEAM, teachers forged new instructional ground that impacted the ways in which their students engaged in and made meaning of larger societal issues such as pollution and environmental co-existence. The students chose the materials they wanted to explore and had the freedom to shape these materials into art products that conveyed their unique ideas and understandings of the world around them. In the process, STEAM Ahead teachers and students were learning together, expanding their creative horizons, and actively participating in issues meaningful and relevant to them.

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