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ABSTRACT

Traditional reviews of arts education have focused on why the arts are valuable for learning, but the arts' contributions to cross-disciplinary discourse remain undertheorized. In this article, we provide a theoretical review of the arts and learning to suggest a new way of thinking about how the arts contribute to learning across disciplines through a focus on the production of artifacts. Guided by a sociocultural constructionist view on learning, this review brings together research from across the field of arts education to demonstrate the benefit of policies that support the production and engagement of shareable artifacts. Findings are synthesized through what we name an *artifact-oriented learning model*, which merges constructionism with ecological systems theory. Our review points to two key pathways of learning through the arts (i.e., making and engaging) and suggests the arts support learning that is multimodal and transactive across settings. Thus, we consider arts education policy as part of a sociocultural process that has rippling effects across disciplines for all layers of a social ecology. Given this orientation, implications for researchers and policymakers are discussed to support decision-making and continued inquiry across arts education research and policy.

The study of the arts in western education has a rich history arcing back to the Greek and Roman eras (Efland, 1990). In writing about his ideal republic, Plato wrote of the importance of the arts in education (e.g., see *Republics*, Bloom, 1991), as well as Aristotle, who valued the arts as a form of education that could inform learners about universal truths through individual experiences with art (e.g., see *Poetics*, Butcher, 1951). In the twentieth century, well-known educational scholars such as John Dewey (1934/1980) and Jane Addams (1902/2002) have written extensively on the role of the arts in education, specifically conceiving of the art object, focusing on the process of making and engaging art, and emphasizing the role of experiences with cultural artifacts at the center of education in a democratic society. The educational benefits of the arts have also been at the core of popular education approaches. Examples include the work of Maria Montessori (Kramer, 1976), who highlighted the role of engaging with materials for child development, as well as the Reggio Emilia approach (Vecchi, 2010), which emphasizes making learning visible by exhibiting artwork as a way of sharing interest-driven

artifacts with a community. The widespread application of Gardner's multiple intelligences theory also features the arts as a way of knowing (2008). Other scholars have theorized sociocultural views of constructionism, which position designing, sharing, and responding to an *artifact* (i.e., an object formed by humans) within a community at the center of knowledge construction (Peppler 2010; Peppler & Kafai, 2010; Papert, 1993; Resnick, 2002).

Most prior arts research and reviews are anchored around discussions of why arts education is important, providing a variety of rationale, including a focus on the nature of the arts classroom (e.g., Hetland et al., 2013), the nature of the arts as a benefit beyond the arts classroom (e.g., Anderson, 2015; Catterall, 2002; Guhn et al., 2020; McCarthy et al., 2004), and the changing nature of the arts (e.g., Gadsden, 2008). As questions pertaining to the arts' value with implications for education policy persist, more rigorous empirical work is needed to show how the arts connect to learning across disciplines (Halverson & Sheridan, 2014). Though some studies show the benefits of arts integration for influencing student

performance in other subject areas (e.g., Cunnington et al., 2014; Hardiman et al., 2014) we lack a precise shared language for how arts learning contributes to cross-disciplinary discourse and education more broadly, as the more prominent focus has been within specific disciplines (e.g., science, mathematics, and language education).

Here we move beyond arguments focused on isolated benefits of the arts. We instead focus on gathering studies of arts learning in a novel way to suggest how arts research can contribute to cross-disciplinary dialogue and support new frameworks for making policy decisions in which the arts are implicated. To frame our contribution, we merge Papert's constructionist concept of thinking through the object (1993) with Bronfenbrenner's sociocultural views expressed through his ecological systems theory (1994) to create what we name *an artifact-oriented learning model* as a way of re-presenting the arts education and learning literature in a holistic way and thus provide a new lens for organizing studies of learning in the arts. Furthermore, using this artifact-oriented learning model, we synthesize outcomes of learning with artifacts in the arts that can enrich cross-disciplinary dialogue. This theoretical review does not cover all arts education and learning literature. Rather, we use our frame to re-present select literature relevant to our goal of new interpretations for how arts learning can contribute to cross-disciplinary dialogue. Our review is focused on the *syntonic* (i.e., interaction between the learner and the artifact) nature of the arts across learning ecologies. The artifact-oriented learning model provides researchers and policymakers with a theoretical framework for approaching arts education literature within the learning ecology. Importantly, aligned with McCarty (2011), our argument is aligned with the notion that "policy is not a disembodied thing, but rather a situated sociocultural process" (p. xii) that manifests in how people take up policy in everyday ways through practice. Given the situated, sociocultural nature of policy, our artifact-oriented learning model can be an organizing tool to support policymakers in sensemaking around current research and practice so as to inform which policy moves can have the greatest tangible impact on the arts education field. Additionally, the artifact-oriented learning model can support the design of new arts integration programs as well as the role of the arts across disciplines as it highlights the value of learning through artifacts across ecologies and disciplines.

Situating the artifact across ecologies

To preview our artifact-oriented learning model, we present an example in which we situate a particular well-known art artifact (i.e., Picasso's *Guernica*) across ecologies. Bronfenbrenner's ecological systems theory suggests that learning happens within a system that includes several nested spheres. These spheres include: (1) the microsystem, which centers the individual learner; (2) the mesosystem, which highlights interactions between settings within the learner's immediate environment; (3) the exosystem, which highlights interactions between settings outside of the immediate environment; (4) the macrosystem, which represents a collective view of the first three spheres; and (5) the chronosystem, which centers change over time across ecologies.

As an example of the multidirectional qualities mediated by the artifact, we can use Bronfenbrenner's ecological systems model to examine *Guernica* by Pablo Picasso, one of the most well-known paintings of the twentieth century (Wilson, 1970). In 1937, Picasso encountered newspaper photographs of the massacre that occurred in Guernica, a small town in Spain. These photographs impacted Picasso directly in his immediate environment (i.e., microsystem) and inspired him to create *Guernica*. While enacted within the microsystem, the painting was a result of Picasso's mesosystem, in which his response to the newspaper images took shape in his studio. In this example, the interaction between Picasso's local visual culture, the art materials he used, his recent work (e.g., see Figure 1), and conversations he had with family and friends are part of the mesosystem. Later that year *Guernica* was displayed at the 1937 World's Fair at the Spanish Pavilion. At that point, the artifact, and the discourse surrounding it, extended beyond Picasso's immediate environment and became part of the exosystem. After the World's Fair, *Guernica* traveled throughout Europe and North America to raise awareness of the threat of Fascism. As a symbol of overarching trends in the micro-, meso-, and exosystems, *Guernica* extended from an artist's expression to a cultural representation of the atrocities of war, which is an example of the artifact in the macrosystem.

Further, looking across eras and cultures in what Bronfenbrenner terms the chronosystem, *Guernica* has symbolized an anti-war message to multiple generations and cultures. For example, in 1985 a tapestry replica of the painting was donated to the United Nations (U.N.) as a reminder for the peace-making role of the international organization. Notably, the power of this symbol at the U.N. was acknowledged

Figure 1. Pablo Picasso (Spanish, 1881–1973). *Minotauromachy (La Minotauromachie)*, 1935. Etching and engraving on paper, image/plate: 19 3/8 x 27 3/8 in.; sheet: 22 x 29 7/8 in. Jane and Roger Wolcott Memorial, Gift of Thomas T. Solley, Eskenazi Museum of Art, Indiana University, 76.64. Photo credit: Kevin Montague. © 2021 Estate of Pablo Picasso/Artists Rights Society (ARS), New York.

when the Guernica tapestry was concealed on February 5, 2003, during then Secretary of State Colin Powell's speech that positioned the United States for going to war with Iraq. After the speech, protestors of the war held up copies of *Guernica* outside the U.N. and a few months later an image of *Guernica* was depicted partially concealed behind drapes on the March 17, 2003 cover of *The New Yorker*. As the *Guernica* example illustrates, the design, creation, and interactive dialogue surrounding an artifact can be mapped across all ecologies, thus providing different entry points for learning or examining policy and its impact across the learner, the environments with which the learner interacts, and understanding how that impact has changed over time. In this paper, we organize each sphere as a separate section in this review, though the borders between spheres are not so distinct, and our placement of the studies within each sphere does not signify that the study represents only one system.

Theoretical framework

Constructionism and the artifact

Seymour Papert (1993), conceptualized the educational philosophy known as *constructionism*, which focuses on learning through the design and creation of

personally meaningful artifacts, partnered with interactions between learners. Though often applied in science and mathematics, the tenets of constructionism, when applied to arts learning, help explain what makes the creation of art such a powerful way of learning and engaging in the world. Significantly, early in Papert's career he had a profound experience in an art room that challenged his concept of learning. He witnessed students carving soap sculptures and noticed the art room culture of making, responding to materials, shifting ideas, responding to one's own work and the work of others, as well as experiencing others' reactions to something an individual had created. In that art room, Papert explained that he experienced something beyond words that aligned with his goal for math classrooms, which led to his career-long pursuit of what he termed *soap sculpture math* (Papert & Harel, 1991). His experience with the art classroom context of artifacts and learners created a mental model for cross-disciplinary thinking about his own research.

Papert, like Vygotsky, maintains that learning is mediated through social and contextual tools. However, though Vygotsky (1935/1978) emphasized spoken language as the primary tool for development, Papert focused on the role of artifacts for mediating learning. From a constructionist perspective, learners construct

knowledge based on experiences with artifacts in the world, which results in learning through processes Piaget (1952) termed as *assimilation* (i.e., when new information is integrated into prior knowledge) and *accommodation* (i.e., when new information modifies prior knowledge). Furthermore, according to social constructionist views, active engagement with artifacts is negotiated within a social context, in which making and responding to artifacts are a form of social communication. This perspective calls attention to how people actively build mental models of the world through interacting with others in a community (Bers, 2008; Papert, 1980).

Papert argues that the artifact becomes an object-to-think-with (1993) because it facilitates an internalized mental structure of physical experience. From this perspective, "people don't *get* ideas; they *make* them" (Resnick, 2002, p. 33). Furthermore, scholars caution against isolating the artifact from its relational properties (i.e., the interaction facilitated as makers and engagers think with the artifact), which runs the risk of reducing it to a static product rather than the active process of meaning making with an artifact (e.g., Springgay, 2006). Meaning is neither inherent in the artifact nor the learner, but rather is made through the relation between the learner and the artifact (Dewey, 1934/1980; Ellsworth, 2005; Parsons, 2002). In contrast, ideas that are not externally expressed (i.e., left inside the mind) do not have the potential to mediate this kind of learning (Parsons, 2002).

Ecological systems theory

According to Bronfenbrenner's (1994) ecological systems theory, learning is developed within an interactive system. The theory includes five key terms: *ecological spheres* (i.e., settings and institutions that impact the learner's development); *systems* (i.e., interactions between learners and spheres); *direct influence* (i.e., impacting the learner in the immediate environment); *indirect influence* (i.e., impacting settings and institutions that connect to, but are not part of, the learner's immediate environment); and *proximal processes*, reciprocal interactions between the learner and other persons, artifacts, and symbols situated within the immediate environment (Bronfenbrenner, 1994, 1995). Table 1 shows the *microsystem* at the center, composed of learners and their immediate environment (e.g., family, teachers). The next sphere, the *mesosystem*, denotes the interactions of two or more settings from the microsystem. Next is the *exosystem*, which includes settings that directly and indirectly

impact learners. The fourth sphere is the *macrosystem*, which is the collective trends of the micro-, meso-, and exo-systems (e.g., world views, cultural customs). The last sphere is the *chronosystem*, which examines how change and consistency over time impact the learner (e.g., the impact of a pandemic on learning or a learner's changing perspectives over a lifetime). In short, ecological systems theory depicts a system of nested spheres of contextual and interactive influences that impact learning. For the purposes of this review, we organize research from the arts education literature within the five ecological spheres to provide evidence for the role of artifacts in learning.

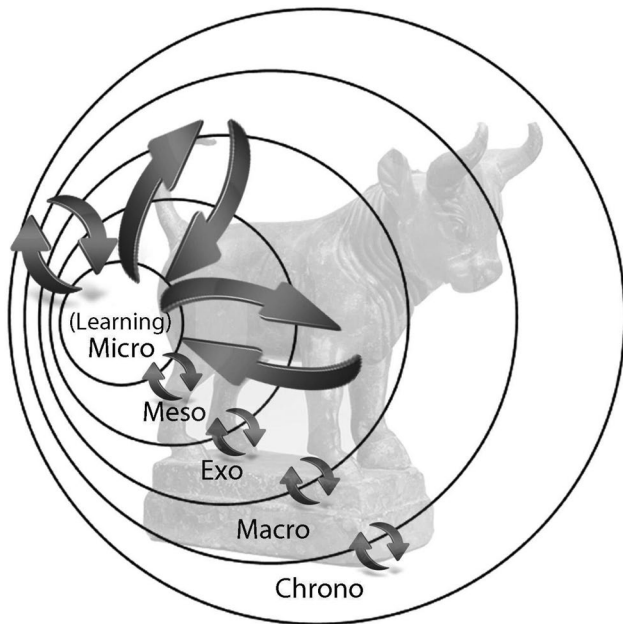## An artifact-oriented learning model

Dewey asserts that *art* artifacts are especially well suited for learning (1934/1980). By their very nature, art artifacts are designed to evoke the learner's attention, perception, and awareness. Using what we name an artifact-oriented learning model, we explore how art artifacts (herein simplified to *artifacts*) in each ecological sphere impact the learner's development by supporting the proximal processes that occur in the learner's microsystem.

Figure 2 illustrates how the artifact initiates a reciprocal relationship between the learner, artifact, and context of each ecological sphere, facilitating a conversation that spans across ecologies. This conversation is multimodal, transactive, and multidirectional. To clarify, we use the term *multimodal* to refer to the simultaneous use of multiple modes of communication (Freedman, 2003; Jewitt & Kress, 2003), the term *transactive* to describe the ability to take on others' perspectives (Eisner, 2002), and *multidirectional* to refer to spanning across multiple learning ecologies (Davis-Soylu et al., 2011; Catterall, 2002; Fiske, 2000; Gadsden, 2008; Greene, 2001; McCarthy et al., 2004).

The act of observing artifacts is explicitly nurtured in the arts (Hetland et al., 2013) as learners are taught to practice "slow looking" (Tishman, 2016) and to develop an "intelligent eye" (Perkins, 1994). To practice the art of close observation and engage an artifact through story, we must develop new literacies that combine multiple modes of representation and communication such as verbal modalities like sequence and plot (e.g., Wohlwend, 2015) while calling upon somatic modalities derived from experience (Bazalgette, 2010), placed alongside visual modalities such as understanding symbols (Kress, 1997, 2003). A multimodal orientation to literacy asserts that image, speech, sound, movement, color choice, brush strokes, and more, contribute layers of meaning that the

Table 1. Descriptions of Artifact Oriented Learning within Bronfenbrenner's (1994) Ecological Systems Theory.

	Bronfenbrenner Definition:	Example Settings:	Artifacts support the proximal processes by:	What research suggests about artifact-oriented learning:
Micro	the immediate environment of the developing individual, face to face settings	family, school, teachers, church group	providing the context where the proximal process is performed	Eisner suggests that each material and art form offers specific affordances and constraints for learning.
Meso	the connections between two or more settings found in the microsystem	reciprocal connections between family, school, teachers, etc.	initiating a visible or external communication that provides connections between school, family, etc.	Greene discusses the value of experiencing other realities against the backdrop of our own lived lives.
Exo	the connections between two or more settings, one of which is indirectly impacting the individual (i.e., not within the microsystem)	parents' workplace, family social networks, mass media, school board, friends of family, social services	supporting learning through indirect influences	The ways in which artifacts are collected and displayed are a form of power, for example criticism around the way art museums display (or do not display) artifacts from marginalized groups.
Macro	the overarching trends in the micro-, meso-, and exosystems of a given culture	cultural customs, attitudes, ideas of the culture	reflecting cultural values	Disciplines such as anthropology & archeology attest to the knowledge gained from the objects we value, create, keep, and leave behind.
Chrono	changes or consistency over the life course in an individual's life, family structure, or environment	changes in perspectives of education during and after a global pandemic	forming human behavior that develops social bonds	Spanning across time and culture, the arts acknowledge and encourage debate about meaning, competing interpretations, and what it is to be human.

Figure 2. Artifact-oriented learning model: social constructionism and the role of the artifact.

beholder interprets with various levels of consciousness depending on prior experience. Thus, when we encounter an artifact, such as a small figure of a bull from thousands of years ago, we draw upon multiple semiotic systems to make meaning about the artifact, about the artifact's maker and time, and about ourselves as we respond to the artifact (Kress, 1997, 2003). This points to the second characteristic of artifact-mediated conversation and learning–that is, it is transactive. In *Handmade Nation* (Levine, 2009), a documentary about the Do-It-Yourself culture in the United States, several crafters summarize how working

with a material, even if you are a novice and it does not turn out well, inspires an appreciation for others who work with that same material. Similarly, Davis-Soylu's (2016) research on interest-driven learner response to public sculpture suggests that learners frequently initiate interpretation by taking on the artist's perspective.

Method

A community perspective on review

Aligned with our perspective that highlights how policy influences social interactions between people, we also consider learning to be a situated, social phenomenon (Greeno, 1998) that takes place as people draw from their prior knowledge and experiences to engage with one another and materials in their environments. Thus, situated, sociocultural perspectives informed both the literature we included in our review and our approach to reviewing the literature. That is, our methodology necessitated that we center the social dimensions of knowing in our approach to information-gathering, aligning with Christians (2005) perspective that "the community is ontologically and axiologically prior to persons" (p. 152). Using a community perspective informed our methods of searching, analyzing, and presenting our synthesis.

Based on the premise that social dialogue and interaction are at the heart of community knowledge (e.g., Nasir & Hand, 2006), we began our review by searching for key portals of dialogue within the arts community. We located central information brokers at the state, national, and international levels, including

leading arts education organizations (e.g., NAEA, Arts Education Partnership, Americans for the Arts, the National Endowment for the Arts, and the International Society for Education through Art). We brought together influential studies of learning and the arts from these communities (e.g., titles included *The Arts and the Creation of Mind* and *Champions of Change: The Impact of the Arts on Learning*). Our review valued the multiplicity of voices as opposed to formal consensus (e.g., Addams 1902/2002; Wang, 1999). As such, we searched for converging viewpoints (e.g., there is wide agreement that esthetic experience is part of learning in the arts) and diverging viewpoints (e.g., there is debate about the role of visual culture in arts education) in order to value the multiple perspectives that have contributed to the dialogue of learning through the arts.

We additionally used a search engine called ArtsEd Search to ensure our review included the rigorous and up-to-date arts education and learning studies. ArtsEd Search is a curated online database of research articles focused on the impact and benefits of the arts in schools and informal learning environments. Run by the Arts Education Partnership, ArtsEd Search aims to help policymakers and other stakeholders "understand and articulate the role that arts education can play in preparing students to succeed in the changing contexts of the 21st Century" (Arts Education Partnership, 2020). The Review Panel for ArtsEd Search uses a two-step community vetting process with already published arts education studies to ensure quality. We listed all articles in the database from the past 10 years, yielding 84 unique entries. We then limited the scope by reading abstracts and key finding summaries to determine where the studies best fit within our ecological frame and included those studies that focused on interactions with artifacts as a means of artistic production or that added a dimension to our argument not covered by our initial community-centered review. While our review was not exhaustive, we coupled our community and sociocultural perspective on information gathering with our review of the last decade of ArtsEd Search to then organize scholarship across ecologies (see Figure 3) so we could make sense of how different studies related to one another and therefore locate openings for cross-disciplinary dialogue.

Artifact-oriented learning across ecologies

In our artifact-oriented learning model, we organize arts education literature across Bronfenbrenner's five
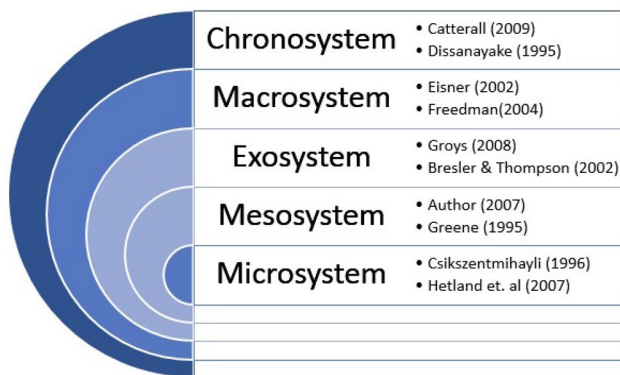

Figure 3. Key scholarship within each system.

ecological nested spheres that impact learning. These include: (1) the immediate environment of the *microsystem*; (2) connections between settings in the *mesosystem*; (3) indirect and direct impact on learners from the *exosystem*; (4) the collective micro-, meso-, and exo-systems in the *macrosystem*; and (5) development over time in the *chronosystem*. We use this organization to discuss implications for arts learning within and across the learning ecology.

Artifacts and the microsystem

Much work has been done recognizing the educative role of artifacts for learners within their immediate environments in the microsystem. A well-known example includes Csikszentmihalyi's (1996) study of *flow*, or professional artists' self-expressed understanding of their own creative moments through making and engaging artifacts. Others have studied the educative role of artifacts by observing student artists and art teachers in their immediate environment. For example, based on research in arts classrooms, Hetland et al. (2013) argued that the benefit of arts education is the cultivation of *studio thinking*, which is divided into eight *habits of mind* or dispositions used to describe artistic thinking. Their study suggests the arts provide distinct benefits for learners, also adding that the arts need not be measured by their usefulness in (i.e., transfer to) other disciplines.

Eisner articulates lessons the arts teach (2002), among which he includes the importance of making and engaging artifacts to learn complex forms of problem solving, to think through and within materials, as well as to expand ideas expressed through artifacts in the external world. Gaztambide-Fernàndez (2013) has also argued that creating artifacts is a form of cultural production. Arts-based lessons within the microsystem also extend to experiences with artifacts beyond the art classroom. For example, Kisida et al.

(2016) studied the impact of taking K-12 students on an art museum field trip. Their randomized study including over 10,000 student surveys indicated that even with only one art museum field trip, there was a positive increase in students' critical thinking skills, information recall, tolerance of others, empathy toward individuals in the past, and cultural interest.

Numerous researchers (e.g., Dewey, 1934/1980; Greene, 1995a, Greene, 1995b, 2001; Housen, 2001; Parsons, 2002; Sefton-Green & Soep, 2007) have found that making and engaging artifacts frequently results in esthetic response (i.e., the heightening of an individual's sensory perception), which is an intimate and profound feature of learning. For example, when responding to an artifact, such as Kiyoshi Saitō's *Winter in Aizu Senes* (see Figure 4), a woodcut print that features a snow-covered village, a viewer may have an esthetic response. Using Papert's terms, the artifact becomes an *object-to-think-with* and can generate memories or feelings of physical cold. In this case, the response is different from a feeling of beauty, which is commonly mistaken as synonymous with the term *esthetic* (Nanyoung, 2006).

Dreyfus and Eisenberg (1986) suggest that an esthetic response is a key goal for math education, whereby students have a heightened sense and appreciation for the function of mathematical thinking. Indeed, Dewey (1934/1980) links all learning to esthetic experience and Parsons (2002) explicitly connects esthetic experience to artifacts outside the self.

Smith (2006) highlights the intrinsic value of esthetic experience, even if not linked to other learning, and suggests arts education is required to develop the capacity for high quality esthetic responses. Other arts researchers point out that experiences with artifacts are not automatically esthetic in nature, but rather meaning is developed through cultivating the reflective and critical eye (e.g., Greene, 1995a; Soep, 2005). Similarly, Freedman (2003) positions the artifact at the center of learning to be a critical consumer of images in everyday life. Sefton-Green and Soep (2007) also point to the emergence of digital esthetics in education, which materialize from new experiences with mass media artifacts such as video games (Gee, 2003) and mobile phones (Kopomaa, 2000).

Artifacts and the mesosystem

The artifact is a catalyst for connecting multiple learners and settings across the immediate environment, a process Bronfenbrenner defines as the mesosystem. Leaders in visitor studies and museum education have written about the educative role of family groups interacting with artifacts in free-choice learning environments (e.g., Talboys, 2011). For example, a grandparent, child, and grandchild can engage a painting in a museum as individuals and as a family group. Less frequent in other disciplines, the arts value shared meaning as well as multiple meanings that are dynamic, relational, and change according to the

Figure 4. Kiyoshi Saito (Japanese 1907–1997). *Winter in Aizu Senes*, 1948–52, Color woodblock print on paper: 9 7/8×15 1/4 in.; sheet: 11 5/8×17 1/4 in. Gift of Robert R. Sturgeon, Eskenazi Museum of Art, Indiana University, 2005.24. Photo credit: Kevin Montague.

viewer (Delacruz, 2005; Eisner, 2002; Williams, 2017). In contrast, thinking with an artifact in the sciences or mathematics often aims at a set meaning, such as gravity or the Pythagorean theorem. Though also supported to various degrees in other disciplines, the diversity of solutions to a problem is at the heart of learning in the arts.

Arts education contexts often facilitate a learning culture that nurtures learning about the self, the social group, the community, and diverse cultures, as well as one's recognition of the connections between each of these. The connective qualities of the arts are particularly relevant to youth in marginalized communities when they have an opportunity to evoke esthetic response through their own narratives and insert their artifacts into the dominant discourse. For non-dominant youth, this can be an empowering and motivating activity because it enables them to develop identities and articulate positions on issues of relevance to themselves and their communities. Greene (1995a, 1995b, 2001) argues that through the arts, an active "social imagination" helps learners transform and "invent visions of what should be and what might be" (Greene, 1995b, p. 5) so that they can "find their voices" and "play participatory and articulate parts in a community in the making" (Greene, 1995b, p. 132). Heath et al. (1998) emphasize that making and engaging artifacts allows individuals to imagine and reflect upon the self as they make things of value to their communities. Malin (2012) shows how making art gives students opportunities for connection, collaboration, and communication as they develop their identities and community roles. As learners build mastery through making and engaging artifacts, they develop critical and reflective dispositions through dynamic interactions with others (Catterall & Peppler 2007; Parker, 2014; Peppler et al., 2010; Simpson Steele, 2019; Soep 2005).

Catterall and Peppler (2007) discuss the impact that engaging and making artifacts has on general self-efficacy in disadvantaged groups, demonstrating that the arts foster a positive and authentic view of one's capabilities and achievements within a group. Baum et al. (1997) also describe how students struggling in other academic areas often thrive in the arts and develop effective learning behaviors that help students become more aware of their personal learning strategies, which can then be used to self-regulate learning in other academic areas. McCarthy et al. (2004) suggest that the arts facilitate collective efficacy that is the belief in the social cohesion and capabilities of the group. Alemán et al. (2017) showed how exposure to the arts can help young people with high exposure to violence improve measures of self-control.

These examples illustrate how artifacts in coordination with other elements such as relationship-building, trust, and comfort, allow learners to bond with other learners and settings while also reflecting on their own learning across contexts.

Artifacts and the exosystem

In the exosystem the artifact is explicitly taken up by the community or social group, which directly and indirectly influences the individual, the community, and how the artifact is seen (Delacruz, 2005; Schlemmer et al., 2017). As learners, we begin to discern these influences through cultural information early in life. Studies have shown that differences among hand-drawings across cultures align with artifacts available in that culture (Wilson, 2004). Similarly, research on esthetic preferences and artistic judgment suggest that there are many differences across cultures. For example, Bezruczko and Frois (2011) found that preferences for symmetry are influenced by cultural artifacts such as the community architecture.

Cultural artifacts are also recognized for their potential within the research process, which has led to new methodologies for *arts-based research* (Leavy, 2009; Siegesmund, 2012), acknowledging the influential and expressive nature of the arts for society. As a methodology, arts-based research aims to establish research questions, share findings, and mine data in evocative and meaningful ways. Poetry, narrative, film, drawing, collage, painting, photography, performance, dance, music, and sculpture are a sampling of the artifacts formed in the practice of arts-based research. Wang (1999) developed *photovoice,* a participatory research method that utilizes photography to assess and promote public health issues. Through photovoice, participants frame their personal views, which allows the researchers and participants to collectively decide which issues are of most importance. For example, within one community the local health department had been focusing on preventing teen pregnancy, while results from a photovoice study found that access to safe recreation for children and teens was a more predominant need in that community's exosystem (Wang & Pies, 2004).

Artifacts and the macrosystem

The macrosystem concerns the collective trends of the micro-, meso-, and exosystems, shifting focus to a broader context. At this level, the artifact becomes a reflection of the time in which it was produced and

its larger cultural and discursive context (Gaztambide-Fernández, 2013). Put simply, we cannot fully understand an artifact's meaning without also understanding the place and time and people involved in its creation (Freedman, 2003). For example, Iznik ceramic is a praised Turkish art form dating back to the Ottoman Empire, which features motifs of stylized flowers and animals (see Figure 5). The Ottomans were fond of Chinese porcelain, which is reflected in the designs and coloring of Iznik ceramics (Freeland, 2001). As this example illustrates, because artifacts help form and reflect the values held by a group of people in a particular place and time, they allow us to learn about diverse cultures.

Contemporary artwork produced within the United States, for example, is reflective of the social and historic moment in which it is produced and at the same time begins to define American culture and contemporary art more broadly. For example, Shepard Fairey's (2016) "We the People" series is a popular and recent example that brings the idea of historical context to light. Fairey created a number of screenprints to highlight the concept of American identity in response to the 2016 election. Across time, by locating and understanding artifacts as part of a macrosystem, we can ascertain the values of another culture or era and how that mirrors or contrasts with our own experiences. Furthermore, developing cultural understanding around issues of race, culture, and class systems may be a key contribution of the arts more generally for

Figure 5. Islamic, Turkish, 17th century. *Plate with Floral Design*, 1600. Earthenware with glaze:1 3/8 x 10 1/8 in. Eskenazi Museum of Art, Indiana University, 61.82. Photo credit: Kevin Montague.

education (Deasy, 2002; Kraehe et al., 2015). For example, youth in one particular art class in Los Angeles were encouraged to explore the ancient Mayan symbol systems and create their own work using symbols that represented themselves as Latinas (Peppler & Catterall, 2006). Additionally, drama has been found to engage youth in social change and build understanding among diverse groups (Mandell & Wolf, 2003). Drama helps youth take on new perspectives through roleplay (Deasy, 2002) to understand character motivations, complex emotions, and social relationships, as it also promotes conflict resolution, engagement, and positive self-concept (Catterall, 2002).

Current and historical research points to the arts as the foundation of democratic ideals, including effects of the arts on positive social interactions, tolerance, and consideration to moral dilemmas (Catterall, 2009). For instance, research suggests that the arts promote empathy, tolerance, and problem solving through taking multiple perspectives (Bertling, 2015; Catterall, 2002). These effects may not just extend to students; they may also impact teachers. For example, Boske (2012) documented how educators increased their critical consciousness and empathetic responses by exploring ideas like equity through arts-based inquiry methods. Additionally, Noblit and Corbett (2001), noted in their evaluation of the A + Schools program in North Carolina that school faculty developed a positive school culture despite typical administrative challenges and lack of resources, suggesting that engagement in arts activities fosters democratic values.

In dance, the South LA Krumping culture, which was popularized through the documentary *Rize* (LaChapelle, 2005), has not only been an outlet for teens to express their deep dissatisfaction with police brutality, but has become a worldwide movement, transforming the canon of contemporary dance (Kafai & Peppler 2008). However, very few of our current conversations around the arts pay attention to the role that art plays in empowering youth in the way that they see themselves, as well as how their work can impact the broader socio-political landscape. This perspective is especially prescient in an age where social networks and online communities provide distribution of power for youth perspectives (Shirky, 2008).

Artifacts and the chronosystem

The chronosystem offers a lens for exploring arts education research as it relates to changes and consistencies over time. For example, Dissanayake (1992) discusses the arts' value on an evolutionary scale by

suggesting that the arts were central to assisting early humans with collaboration, building communities, and ultimately surviving while other species did not. Daniel Pink's (2006) work depicts a future that places the arts and imagination at the center of twenty-first century educational goals. As the world is transformed by digital media into a global community, learning through the arts becomes increasingly important. This future orientation as part of the chronosystem builds upon artifacts' shared historical and cultural contexts. Vygotsky (1930/2004) explained that imagination is a result of combinatorial action, meaning that as learners create, the ways in which cultural and historical tools have been used and appropriated over time is embedded in activity. Thus, new innovations do not simply appear out of thin air––creative artifacts come to be based on prior experiences their authors have in the social world as well as through a shared cultural history embedded in the artifacts. Vygotsky explains, "It is precisely human creative activity that makes the human being a creature oriented toward the future, creating the future and thus altering his own present" (p. 9). We take this to mean that through the literal objects that people make, they are calling upon shared histories embedded in those artifacts and the activities around those artifacts as they actively construct new meaning through their making.

Literature that tracks longitudinal progress in arts learning over time can also be positioned within the chronosystem. Recent longitudinal studies include studying the impact of music instruction on memory (Roden et al., 2012) and other cognitive skills (Hille & Schupp, 2015). Additionally, participation in the arts over time has been correlated with decreased dropout rates (Thomas et al., 2015). Long-term effects of arts and arts integration programs have also included supporting students' self-concepts and relationships with others (Simpson Steele, 2019), improvement in literacy skills (Heath & Soep, 1998; Walker et al., 2011), and positive identity development through participation in arts programming (Holloway & LeCompte, 2001). Catterall (2009) shares longitudinal research to explore the impacts of long-term arts involvement for 12,000 participants. Notable findings include: when comparing arts-engaged participants with non-engaged participants, the arts-engaged participants were, "three times as likely to have earned BA degrees…more than twice as likely to have earned associate degrees, and nearly three times as likely to have earned masters or higher degrees" (p. 60). Participants with higher exposure to the arts were also more likely to volunteer in youth or community organizations and to vote in presidential elections. These results are contrasted with students who had high-engagement in high school sports. Comparing high-engagement in this way (as opposed to high *arts* engagement) to non-engagement showed little difference. For example, participants involved in sports in high school have a high likelihood to continue playing sports, but playing sports in high school did not lead to trends of volunteering and other civic actions. Here we see how learning in the arts generates consistency over the course of an individual's life, in what Catterall describes as *doing well and doing good by doing art* (2009).

Discussion

Our theoretical review brought together Papert's theorization of an-object-to-think-with and Bronfenbrenner's ecological systems theory to frame arts education and learning literature. Broadly, we aimed to bring relationships between learners, learning, and artifacts into focus within the arts education research and suggest possibilities for how artifacts can be a point of departure for organizing policymakers' sensemaking about arts education research as well as furthering arts integration and STEAM policy arguments. By re-presenting arts literature in a holistic way through an artifact-oriented learning model, we aimed to show how studies of learning in the arts might be better organized to support conversations about how the arts impact learning within and beyond arts disciplines. By clustering studies in relation to one another in this way we can begin to see how arts research fits into a larger ecology of learning, thus supporting the development of a common language for discussing the disparate arms of arts research. The artifact-oriented learning model brings the role of the object into focus within the learning process, highlights the relationship between the learner and object, and suggests an explanatory model for how that relationship extends across ecologies. We consider the major contributions of this theoretical review to be twofold with implications for research and policy: (1) artifact-oriented learning re-presents a way of situating arts research with a focus on how the object organizes learning and how that learning takes shape across ecologies; and (2) artifact-oriented learning suggests possibilities for conceiving of future research and policy emphasis focused on cross-disciplinary learning and the arts.

Artifact-Oriented learning as an organizing tool

As new studies in arts learning come into focus and are vetted by the field's recognized information

brokers, an artifact-oriented learning model can help us situate this research to support a common language to bridge between different ecological layers and thus consider how learning extends across ecologies, such as how personal or social aspects of creative production connect with historical dimensions of art. One notable use of the model is that the outer rims can help us use art to understand how artifacts are situated in other cultures and time periods by relating these dimensions to learning in other layers. This model can thus support the decision making involved when considering how a macro-level policy might impact interpersonal relationships between students and teachers in interaction in classrooms. An artifact-oriented learning model encourages a policy perspective that is human-centered and considers a range of related effects.

Artifact-oriented learning can further shape sense making around arts learning. A relevant example from arts education research connected to learning with and through artifacts includes a study that investigated the micro- and mesosystems of how individual youth collaboratively engaged with e-textile materials to create interest-driven artifacts that bridge STEM learning with the artistic process (e.g., Bender & Peppler, 2018). Under the artifact-oriented learning model, the process of creating an e-textile could be considered in relation to politics (within the exosystem) of a broader Do-It-Yourself culture and maker movement in education (Dougherty, 2012) as well as a history of gendered assumptions (in the macrosystem) about who gets to engage with STEM learning (Buechley, 2013). Within this specific case, the chronosystem represents how the individual story of a learner's making and engaging with an artifact is impacted over time by a variety of factors such as how e-textiles have disrupted what STEM learning looks like and furthermore, who gets to participate in such learning (Peppler, 2013). The artifact-oriented learning model helps us see this single study from many perspectives nested across ecological layers, thus opening up how we understand and talk about learning in the arts. The model also encourages policymakers to consider precisely how arts education policy efforts such as those outlined in the National Coalition for Core Arts Standards (2014) and subsequent state revisions present possibilities for bringing explorations of interactivity and digital media arts practice to arts classrooms through the merging of the arts with other subject areas, such as science, technology, engineering, and math, as well as language arts.

The artifact-oriented learning model can help researchers and policymakers understand and locate points of connectivity across invisible or artificial boundaries of research. For example, artifact-oriented learning offers the organizational structure required to understand how a study on the effects of arts integration on student achievement and school climate (Snyder et al., 2014) might be put into dialogue with how policy impacts art teachers' personal and professional responsibilities (Freedman, 2007) or research on how the arts and movement therapy contribute to social-emotional outcomes (Anderson, 2015) in the microsystem. This mirrors calls from members of Congress to integrate STEM and Art disciplines in US schools (Bonamici & Schock, 2014), citing research that demonstrates the impactful learning that transpires as students learn to think "through materials," as well as updates to the school curriculum for the age of digital innovation (Guyotte et al., 2014). In this way, the model presents possibilities for making connections and forming relationships between disparate research and sources to find places of convergence and therefore locate opportunities for further dialogue, study, and thoughtful, research-based policy making that takes seriously the impact of policy on individuals and interpersonal relationships.

The artifact-oriented learning model provides the opportunity to examine which systems get attention in current policy, and which systems might need additional attention from policy researchers and reformers. As one example, looking at arts policy on Diversity, Access, Equity, and Inclusion through this model underscores the complexities of the inequalities of the digital divide. Through this model, this issue can be approached at many system levels. The microsystem level frames policy that considers students' immediate home environments that may not have access to reliable internet. Through considering the mesosystem, policy can explore the difficulties of bridging students home and school environments. At the exosystem level, policy can be analyzed and developed that focuses on direct and indirect impact, such as school district level policy and funding. Framed within the macrosystem, the collective trends of the disparities in access to online learning can be further framed. Similarly, the chronosystem provides a framing for considering corrective policy that ameliorates technology inequities for students in diverse learning contexts in the future.

Bringing connections across disciplines into focus

Formal art education in the United States began as an integrated discipline with an emphasis on drawing in Benjamin Franklin's (1749) academy in Philadelphia.

The Industrial Revolution also encouraged drawing as a technical skill that should be included in the general education setting. Similarly, art at the university level began in other departments such as science and anthropology. For example, drawing was a subject taught in the School of Science at Yale long before the School of Fine Arts was established. In more recent years however, these historical traditions have been eclipsed through current day educational policy imperatives that center science, math, and literacy. Often missing from these conversations is the enduring role that the visual, performing, and musical arts play in education. Some recent exceptions include explicit cross-disciplinary arts integration efforts in which students learn to demonstrate comprehension of a subject through an art form (e.g., Brouillette, 2020; Duma & Silverstein, 2014) and selected studies of transfer from arts subjects to other disciplines (e.g., Goldstein et al., 2013). Additionally, inter- and trans-disciplinary policy conversations about integrating art with STEM subjects to form "STEAM" (Platz, 2007) have become more commonplace, thus creating experiences that transcend these disciplines and afford new possibilities for learning (Peppler & Wohlwend, 2018). STEAM approaches, for example, may blend traditional art artifacts such as origami with paper engineering to support specific learning outcomes such as visuospatial thinking (Taylor & Hutton, 2013). Through thoughtfully enacted policy that merges STEM with arts subjects, collaborations can be supported through intentional design of cross-, inter-, and transdisciplinary curricula that emphasizes maker-centered practices. For example, artifact-oriented learning may suggest systematic integration of design thinking and the making of prototypes as part of a transdisciplinary way of thinking about arts curricula and pedagogy (e.g., Lim et al., 2008; Penuel et al., 2007; Saxena et al., 2021). Patton and Knochel (2017) have called to make stronger connections between the affordances of arts spaces and makerspaces, acknowledging their synergistic potential for learning across disciplines. Adding to such cross-, inter-, and transdisciplinary initiatives, this review calls for future dialogue and investigations into the differing effects of the arts across disciplinary boundaries.

Policy recommendations for an Artifact-Oriented learning model

An artifact-oriented learning model suggests several recommendations for arts education policy and policymakers. First, as described above, the artifact-oriented learning model could be used by policymakers as an organizing tool or way of examining the current research to inform policy. For example, exploring the impact of the arts using the lens of the mesosystem could highlight how the different environments in which young people might learn about art and artifacts such as in school, community, and home contexts, could impact the development of the individual learner. The artifact-oriented learning model could help policymakers assess the field and what is coming out of it in making research-based plans for policy. In this way, an explicit recommendation the artifact-oriented learning model suggests is to use such a model in decision-making contexts so that policymakers are both attending to what is and is not present in the current research as well as considering implications of policy for learners across ecologies.

An artifact-oriented learning model could also help strengthen existing arts education policy arguments. For example, artifact-oriented learning could support argumentation for what Julia Marshall (2016) has called "a systems view" on how the arts play a role in arts education, as it frames how learning through artifacts is relevant across ecologies and disciplines much like how Marshall argues that the arts ought to be integrated across the curriculum. Furthermore, the artifact-oriented learning model supports arguments for cross-, inter-, and transdisciplinary learning (Costantino, 2018), showing how artifacts connect disciplines to one another in arts integration or STEAM education contexts. As part of the STEAM policy conversation, an artifact-oriented learning model can provide an entrypoint for creating tangible educational models for STEAM (Allina, 2018) based on the production of artifacts. Creating a common language for STEAM teaching and learning practice would be invaluable since there is little documentation of pedagogy and research within the field (Katz-Buonincontro, 2018). Using the artifact-oriented learning model to generate recommendations for STEAM policy can also holistically support arguments for the need to prepare youth with necessary skills to enter the rapidly evolving creative economy, which OTIS College of Art and Design describes in their annual report as including "people with creative occupations working the creative industries, as well as workers with creative occupations working in any other industry, and people in a non-creative job working in a creative industry" (OTIS, 2019, p. 9). The artifact-oriented learning model would have policymakers consider the implications of policy through different ecological spheres to support decisions about arts education and learning.

Limitations and future directions

The artifact-oriented learning model has certain limitations for how it organizes the arts education literature. A surface-level interpretation of artifact-oriented learning may inadvertently leave out processes and ways of knowing particular to the arts that do not become cemented in physical artifacts over time. Theoretically, art artifacts are not just physical objects, but as Dewey (1934/1980) explains, they are "perceived by a cumulative series of interactions" (p. 228) as people engage with and make meaning around them. That is, to Dewey, art is about embodied sensations of experience that extend beyond interactions with physical objects. As such, art artifacts can be defined more expansively to include arts or subjects that are not so much focused on the creation of physical artifacts, perhaps instead connected to more conceptual kinds of making, highlighting those experiences that tap into the sensory experiences of different disciplines. For example, while in the process of choreographing a dance, the many iterations the dancer makes may not make it into the final representational artifact (which, in this case, is not a physical object to hold, but a dance performance to watch). Within this example, the "artifact" is conceived of as an embedded part of art as an experience, of the viewer's sensory interactions with the embodied dance artifact. Though our model development thus far mainly includes reference to physical artifacts, we consider this a limitation of the current state of our review and acknowledge the expansive nature of how we might conceive of artifacts that are both physical and conceptual in nature in relation to the model and Bronfenbrenner's ecological layers. In addition to broadening the view of what counts as artifacts within this model to include nonphysical artifacts, further theorization of the artifact-oriented learning is needed for understanding how erasures and revisions such as those suggested in the choreographic process above are embedded and made present in artifacts, whether they be conceptual or otherwise embodied.

Additionally, artifact-oriented learning assumes a constructionist perspective on learning that considers objects part and parcel of cognition. That is, the connection between making physical objects and intellectual work is embedded in the artifact-oriented learning model, rejecting artificial separation between the brain and hand (Rose, 2008). Thus, because the model is firmly situated in particular epistemological and ontological beliefs about learners and learning, an artifact-oriented learning model may not lend itself to other ways of knowing that may be in conflict or in addition to social-constructionist theories of learning.

Recognizing these noted limitations, the process of organizing research across different ecological layers also brings several areas for future research to the surface. To name a few, the model can help us identify specific layers to target in future work; bring artifacts to the forefront of an arts learning research and policy agenda; and position arts learning research as part of a larger educational context. For example, a review of recent publications in top-tier art education journals that places the work within these systems might be one way to study current policy gaps and opportunities. Additionally, the artifacts with which people engage are central to understanding the ways they participate and can help to organize and focus aims of cross-disciplinary learning.

Conclusions

John Dewey suggests that art is proof that people use materials with the intent to expand one's own life as well as a form of communication with others. According to Dewey, "[a]rt denotes the process of doing or making," and provides a tool by which we search for meaning (1934/1980, p. 47). We have suggested that an artifact-oriented learning model offers researchers and policymakers, as well as learners, additional tools to search for meaning. We have argued that the arts are an important and often overlooked area for cross-disciplinary education scholarship and the artifact-oriented learning model offers a way in for researchers and policymakers looking for a common language to focus on how arts learning contributes across a range of disciplines. Additionally, an artifact-oriented learning model can help locate areas for future research with the artifact––be it explicitly art-based or not––as a central point of departure for study. By re-presenting the arts within the broader educational discourse through Bronfenbrenner's ecological systems theory and drawing from Papert's focus on the role of objects in learning, we have reviewed pertinent literature as well as illustrated that the arts are a resource for advancing understanding of learning. Through reviewing and re-presenting prior arts education and learning literature, our intention has been to spark new dialogues for research and policy both within and outside traditional arts-specific disciplines.

Disclosure statement

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