Arts Integration and STEAM: Defining the Framework for Museum Educators

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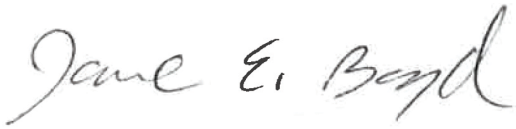

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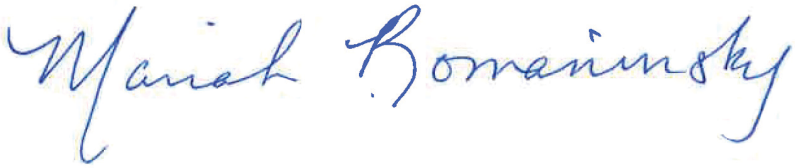

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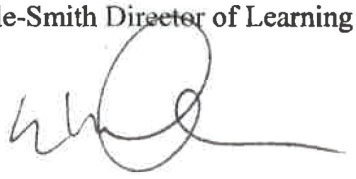

Abstract

The perceived division between the arts and sciences is widening in America. To combat this division, educators are emphasizing the importance of arts integration and STEAM (science, technology, engineering, arts, mathematics) initiatives. Arts integration and STEAM not only help to preserve a place for the arts in the curriculum, they have also been shown to enhance STEM and overall science learning. Arts integration in particular is of special interest to museum educators who feel that they can provide resources to help teachers integrate the arts into scientific disciplines.

The term arts integration has many definitions across the education field. The purpose of this paper will be to review the current literature on arts integration and STEAM, noting how the terms are defined in both formal (K-12) and informal education realms. In addition, by providing a qualitative study on how current professionals from both art and science institutions are defining arts integration and STEAM, this thesis will bring clarity to these ambiguous terms. In congruence with definition of terms, interviews will provide information on the efforts by museums to support their communities through arts integration and STEAM programs, including lesson plans, field trips, conferences, and professional development opportunities. Through this research study, museum educators will have a more consistent definition of these terms so that when the terms are used in practice there is a common framework for reference, expanding the overall understanding and application of arts integration and STEAM in museums, and better supporting the needs of school and educators.

Dedication

To Graham, who is amongst the stars, this is for you.

Acknowledgements

I would like to thank my advisor Ellen Owens for her continuous patience and guidance throughout this process, and for inspiring me to finish strong. I would like to thank everyone on my committee for their expertise and encouragement of which I am eternally grateful. Additionally I would like to express gratitude to my fellow classmates for their continued spirit to the very end.

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Nomenclature and Abbreviations

21st-century skills The skills, abilities, and learning dispositions that have been identified as being required for success in 21st-century society and workplaces. The most popular learning strategies today are the 4 C's: critical thinking, creativity, collaboration, and communication.[1]

Arts integration An approach to teaching and learning through which content is taught and assessed equitably in and through the arts.

Critical thinking The objective analysis and evaluation of an issue in order to form a judgment.

Constructivist Learning Theory The idea that learners construct knowledge for themselves; each learner individually (and socially) constructs meaning as he or she learns.

Design thinking Process from which design concepts emerge; encompasses cognitive and practical activities.

Formal education K-12 Education that occurs in school classrooms, provided by certified teachers.

Informal education Education that can occur outside of a structured curriculum; in this case, a museum setting.

Interdisciplinary Relating to more than one branch of knowledge.

Inquiry A seeking or request of truth, knowledge, or information; an investigation.

Lesson plans An educator's detailed description of the course of instruction or "learning trajectory" for a lesson.

Museum programs Used by a museum to stimulate informal learning experiences.

Professional development A type of program devoted to the process of improving and increasing capabilities of educators through access to training opportunities.

Transdisciplinary approach An approach to curriculum integration that dissolves the boundaries between the conventional disciplines and organizes teaching and learning around the construction of meaning in the context of real-world problems or themes.

[1] There may be variation on the wording of these skills, but they all encapsulate the same ideas.

Common Core State Standards (CCSS) A set of high-quality academic standards in mathematics and English language arts/literacy (ELA).

Inquiry-based learning (IBL) Form of active learning that starts by posing questions, problems or scenarios, — rather than simply presenting established facts

National Science Foundation (NSF) United States government agency that supports fundamental research and education in all the non-medical fields of science and engineering.

Project-based learning (PBL) A student-centered pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems.

Claim, evidence, reasoning (CER) An explanation that consists of a claim that answers the question; evidence from students' data; and reasoning that involves a "rule" or scientific principle that describes why the evidence supports the claim

STEAM Uses science, technology, engineering, art, and math as access points for guiding student inquiry, dialogue, and critical thinking

STEM Science, Technology, Engineering, Mathematics

Chapter 1: Introduction

The perceived division between the arts and sciences was not always apparent. Leonardo da Vinci created works of art that inspired generations, but he also made blueprints for an airplane-like device and captured human anatomy in detailed drawings. He observed the world around him and recorded these observations in journals. He used these studies to inform his paintings, thereby using his scientific observations and knowledge to inform his art. His body of work serves as one of the most influential examples of art and science integration. Over the centuries, to explain the workings of the universe, scientists increasingly favored mechanical concepts, leaving emotional concerns to the arts. During the nineteenth century, scientific developments were heavily dependent on industry and economics.[2] Specializations were emphasized and school and university curricula made it difficult for students to study both art and science subjects simultaneously.

In 1959 C.P. Snow, English novelist and physical chemist, gave a speech in the Senate House in Cambridge. The title was "The Two Cultures and the Scientific Revolution", with themes about the dangerously wide gap that had opened up between scientists and "literary intellectuals". He compared the British system unfavorably to the USSR (Union of Soviet Socialist Republics) and United States, stating children were forced to specialize at an unusually early age, and pushed towards the "traditional culture" and professions rather than science and industry. Snow believed there was only one way out of this and "it is of course by rethinking our education."[3] While Snow spoke about education in the United Kingdom specifically, his argument remains valid because it raised important questions about the nature of education and

[2] Eliane Strosberg. *Art & Science*. 2nd ed. New York: Abbeville Press Publishers, 2015.
[3] Robert Whelan. "Fifty years on, CP Snow's 'Two Cultures' are united in desperation," *The Telegraph*, May 5, 2009. https://www.telegraph.co.uk/technology/5273453/Fifty-years-on-CP-Snows-Two-Cultures-are-united-in-desperation.html.

what we expect it to achieve. There is no universal agreement on why or how the arts and sciences became disconnected, but the division clearly has some artificiality. Some assume that the arts are about creativity and the sciences are about rigorous application of techniques and methods. This is an oversimplification because all disciplines need *both.* The best science requires creative thinking. One has to see a problem, form a hypothesis about a solution, and then figure out how to test that hypothesis and implement its findings. All of that requires creative thinking, more often referred to as innovation. As for artists, creativity alone fails to deliver anything of worth. Artists must also learn technique in order to turn their thoughts into a work; they must attain mastery over their medium.

Today, the division between arts and sciences is particularly true in the field of education, in which they are often viewed as competing disciplines in the struggle for both instruction hours and funding. For example, the National Science Foundation (NSF) funds over five billion dollars to programs and initiatives for science education, while the arts and humanities only receive about 250 million dollars per year.[4] In 2001 Congress passed the No Child Left Behind (NCLB) Act that was signed into law by President George W. Bush in 2002. In the United States, NCLB introduced a requirement that new educational programs be subject to rigorous scientifically based research that proves they are effective. The Act supported standardized testing requiring states to develop assessments in basic skills. To receive federal school funding, states had to give these assessments to all students at select grade levels. Critics argue that this focus on standardized testing encourages teachers to teach a narrow subset of skills that the school believes increases test performance, rather than achieve an in-depth understanding of the overall

[4] "11 Facts About Art Education," DoSomething, February 2014, accessed September 20, 2018, https://www.dosomething.org/us/facts/11-facts-about-arts-education.

curriculum.[5] Outside of formal education, museums can provide various opportunities and resources for individuals of all ages; this is particularly true for K-12 students who attend public, private, or home schools. Museum programming not only allows students to participate in activities that assist in understanding of academic materials in the classroom, but also offers ways for students to develop the skills necessary to effectively integrate social, emotional, and academic development. Museum programming can encourage students to understand their own capabilities and develop those skills to improve their knowledge. Not only beneficial for student learning and engagement, museum programming can also provide examples of teaching skills that formal educators can choose to reiterate in the classroom setting. When both formal and informal educators have similar or relatable approaches to teaching the same subject matter, it is the students who will ultimately benefit from this consistency.

To understand the importance of arts integration, it is essential to know about STEM (science, technology, engineering, mathematics) and STEAM. Judith Ramaley, former director of the NSF Education and Human Resources Division, coined the term STEM in 2001.[6] Ramaley believed that science and math are critical to a basic understanding of the universe, while engineering and technology are means for people to interact with the universe, and that "STEM weaves those elements of human action and understanding into all aspects of education."[7] The concept of STEM was not merely to focus on individual subjects, but rather to *integrate* these four disciplines by showing real world application.

In 2006, the U.S. National Academies expressed their concern about the declining state of education in the United States particularly in the areas of STEM. They recommended improving K-12 science and mathematics education, providing additional training for teachers in these

[5] David Sousa and Tom Pilecki, *From STEM to STEAM*, (California: Corwin, 2013), 1-2.
[6] Jerome Christenson, "Ramaley coined STEM term now used nationwide," *Winona Daily News*, November, 2011.
[7] Ibid.

areas, and increasing the number of students entering college for STEM-related degrees. In 2007 Congress passed the America COMPETES Act, which authorized funding for STEM initiatives from kindergarten through graduate school.[8] Despite good intentions and substantial funds spent to encourage the STEM initiative, progress has been slow. In response, national science organizations are developing the Next Generation Science Standards (NGSS) to better prepare K-12 students in the sciences for careers and college. Regardless how good the NGSS are, many believe they will do little to improve student learning unless school curriculum becomes more meaningful, and unless science and mathematics instruction concentrate more on creative and real-world problem solving.[9] Integrating arts-related skills and activities into STEM courses could be one very effective way to enhance student interest and achievement, while also preparing students for careers in STEM-related fields where emphasis on these skills are inevitable.

Today, many educators argue that by focusing solely on STEM subjects in school, students are not acquiring vital skills that can be developed by engagement with the arts, such as creativity, collaboration, and critical thinking.[10] To clarify, the issue is not with the subject of STEM itself, but rather the way STEM subjects are taught in formal K-12 education. It is evident that the thorough study and application of the scientific, technical, and mathematical principles embodied in the STEM subjects require skills that can be significantly enhanced by training in arts-related areas. Because of this, many educators and professionals believe in the pursuit of integrating the arts into STEM subjects to form STEAM lessons. The STEAM movement was championed by the Rhode Island School of Design (RISD) and adopted widely by institutions, organizations, and individuals. The primary objectives of this STEAM movement

[8] David Sousa and Tom Pilecki, *From STEM to STEAM*, (California: Corwin, 2013), 37.
[9] Ibid., 9.
[10] Ibid., 14-15.

are to transform research policy to place art and design at the center of STEM, encourage the integration of art and design in K-20 education, and influence employers to hire artists and designers to drive innovation.[11] Doing so will help educators better understand how arts-related skills and STEM skills can work together to enhance the attainment and retention of learning. STEAM was developed using principles of Inquiry-Based Learning (IBL) using a combination of problem solving, hands-on projects, and design-based learning. By thinking about what they are doing along the way and reflecting at the end of the process, students get a chance to experience the material and gain an in depth understanding of it. For the purpose of this thesis, research on STEM and STEAM will focus primarily on science and art related disciplines since most of the informal institutions discussed are science and art institutions that utilize STEM or STEAM initiatives in their programs.

The term "arts integration" has also evolved over the past fifteen years as school districts and arts organizations experimented with various forms of implementation. According to Gail Burnaford, current interest in arts integration has not appeared to produce a consensus on the theory or practice of integration, much less a universally held definition of the word. Practitioners usually speak of interdisciplinary studies, a multidisciplinary curriculum, and integrated learning in relatively interchangeable terms. In 2003 Richard Deasy referred to arts integration as "the effort to build a set of relationships between learning in the arts and learning in the other skills and subjects of the curriculum,"[12] also noting that arts integration means different things to different people in different situations and context. Arts integration and STEAM initiatives have been of special interest to many formal educators who teach in a K-12 setting, as well as museum educators who feel they are in the perfect position to provide

[11] "What is STEAM?," STEM to STEAM, accessed October 17, 2018, http://stemtosteam.org/.
[12] Gail Burnaford, "Arts Integration Frameworks, Research, and Practice," (April 2007): 11.

resources to aid teachers in these practices to help fill the gap in the education of many students today. Many museums have the opportunity and the resources to enhance school curricula not only with tours and after school programs, but also by providing lesson plans and professional development opportunities to educators. Because of the museum's role in education, the primary audience for this thesis is intended for museum educators who wish to better understand the term arts integration and what that looks like compared to STEAM practices.

Research Problem

As noted above, arts integration has many varying definitions across the field, which will be discussed further in the review of the literature in the following chapter. At its core, arts integration is defined as "an approach to teaching and learning through which content standards are taught and assessed equitably in and through the arts."[13] Through this method, students will engage in a creative process that connects an art form and another subject area, meeting evolving objectives in both. In this definition, it is understood that arts integration is larger than an "activity." Rather, arts integration is an approach to teaching that is *imbedded* in one's daily practice. Though this definition is clear, it is evident in the Literature Review chapter of this thesis that current professionals' definitions are inconsistent.

Purpose of Study

Since there are varying ways in which professionals are defining and practicing arts integration and STEAM, the purpose of this thesis is to point out these inconsistencies through both the current literature and qualitative interviews, in the hopes of creating a common

[13] Susan Riley, "Arts Integration," *Education Closet*, accessed August 21, 2018, https://educationcloset.com/topics/approaches/arts-integration/.

framework for professionals in the future. By conducting qualitative interviews, the researcher was able to gain a comprehensive understanding of *how* professional educators in both science and art institutions are defining arts integration and STEAM, and to evaluate *what* they are doing in their own institution that reflects these practices. To ensure the researcher was not only getting perspectives from a strictly art or science point of view, interviews were conducted with professionals in both fields of study, and in both types of educational settings (formal K-12 and informal). It is evident that professionals see the benefits of making connections between art and science disciplines. It is important, however, that they are on the same page when it comes to definition and practice for future application in the field.

Research Objectives

The primary objective of this thesis is to come to a clear consensus of what arts integration and STEAM mean to current professionals in museum and K-12 school settings, and also what these terms *look* like in practice. By asking professionals how they define arts integration and what type of programs their institution offers to implement these practices, the researcher will draw conclusions about the current state of arts integration and its relationship to STEAM, noting if the terms are used interchangeably. Also, by reviewing current programming in museums across the nation, the researcher will provide professionals with examples of these practices in both science and art museum settings.

Significance to Field

Since the bulk of the research for arts integration comes from the formal K-12 setting, this research will primarily benefit those professionals who work in informal institutions, in

particular art museums and science centers. The primary audience for this thesis will be museum educators ranging from those who currently practice or have intentions to practice arts integration, to those who simply wish to know more about the ways the arts can be integrated into other disciplines. This thesis hopes that by providing a clear definition of the term arts integration, educators who wish to practice these initiatives will not only be advised on the current literature in the field, but also advised on how other professionals are defining the term and how it is approached in their own institution. Having most of the research on arts integration from a formal perspective emphasizes the importance of the relationship between informal and formal education. While both environments for learning are very different, it is important to note that every student has varying strengths and ways of learning, and that formal and informal education can be combined to create a multi-layered web of learning for students. The connection between formal and informal educators is important because ultimately it is the role of both types of educators to teach fundamental subjects through arts integration practices to K-12 students. It is the museum educator's role in particular to teach these methods to teachers who wish to practice it in their own classroom. If the goal is for students to make connections between disciplines and acquire the proper skills to help them in their future careers in the 21st century, then K-12 educators *and* museum educators must share similar language and complimentary approaches to one another to better foster student learning.

Chapter 2: Literature Review

For the sake of clarity and consistency, the literature for this thesis will need to include a section on the differences and similarities between arts integration and STEAM. Through recent research it has become clear that there are variations, not only in terminology, but in approach and standards as well. The current literature is inconsistent in recognizing these differences. Therefore, the first section of the literature will focus on what is already known about arts integration and STEAM. There is a large body of research on these topics; however, most of this research is in formal settings. Knowledge about arts integration and STEAM in formal settings will serve as a foundation for this research and will ultimately give more insight into the research in informal settings. The second section will focus on efforts to support these areas of practice, and contextualize how arts integration and STEAM are being discussed and addressed. The final portion of this literature review will look at specific arts integration and STEAM practices including conferences, professional development workshops, and programming.

Literature Review: Arts Integration and STEAM Research

Although there seems to be an inconsistency in the literature about arts integration and STEAM, there is a consensus in the notion that there is synergy between the arts and sciences. June Bianchi of Bath Spa University in the United Kingdom states that "innovative strategies suitable for 21st Century development in education, industry, and culture can emerge from the integration of the arts with STEM areas of knowledge."[14] Educators across the globe are coming to understand the vital importance in challenging the polarized views of art/science, creative/logical, right brain/left brain thinking; and pose that STEAM promotes the increased

[14] June Bianchi, "STEAM Power: Integrating Art and Technology through Cultural Heritage Museum Partnerships," *The International Journal of the Inclusive Museum* 9, no. 2 (2016): 59-75.

potential for this interdisciplinary fusion. Bianchi attests that the integration of art with STEM is what creates STEAM, and offers case study material based on two STEAM projects from Bath Spa University. The projects do not state evidence for the benefits of cross-curricular engagement, but instead provide a model for successful methodology for this interdisciplinary synthesis. Bianchi concludes that this binary division of disciplines must be challenged, stating, "STEAM creative strategies and pedagogies can push the boundaries of traditional subject disciplines, re-integrating conceptual frameworks and approaches to generate innovative thinking, creative insights, and unexpected outcomes."[15] Although this study is based in the United Kingdom, the research is still relevant for educators in the United States because of the general lack of understanding of the relationship between STEAM and arts integration.

Since the 1990's, the Kennedy Center has been working with a network of schools in the Washington, D.C. area to provide professional learning experiences for teachers in arts integration and how to implement it in classrooms. In 1996 the Kennedy Center instituted ARTSEDGE, a national network for arts education focused on ways to support innovative teaching with the arts. According to the ARTSEDGE website, of the 11 million people who participate in KC education department programming each year, 4 million do so through ARTSEDGE resources.[16] Given the growing interest in arts integration, the Kennedy Center began to focus some of its efforts on reaching all teachers within a school with intensive professional learning. To accomplish this goal, the Kennedy Center established Changing Education Through the Arts (CETA) in 1999. Due to their investment in time and effort over the years, the Kennedy Center proves to be a valuable resource for understanding arts education and arts integration practice.

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[15] Ibid., 73.
[16] ArtsEdge, "What is Arts Integration?" https://artsedge.kennedy-center.org/educators/how-to/arts-integration/what-is-arts-integration

The program Changing Education Through the Arts (CETA) uses a comprehensive definition of arts integration as its foundation, helping over 400 teachers in the program know exactly what arts integration is and how it differs from teaching the arts or just using arts in the classroom. According to Lynne B. Silverstein, arts integration is "an approach to teaching in which students construct and demonstrate understanding through an art form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both."[17] Through this definition, arts integration can provide students with multiple ways to make sense out of what they learn and develop a deeper understanding.

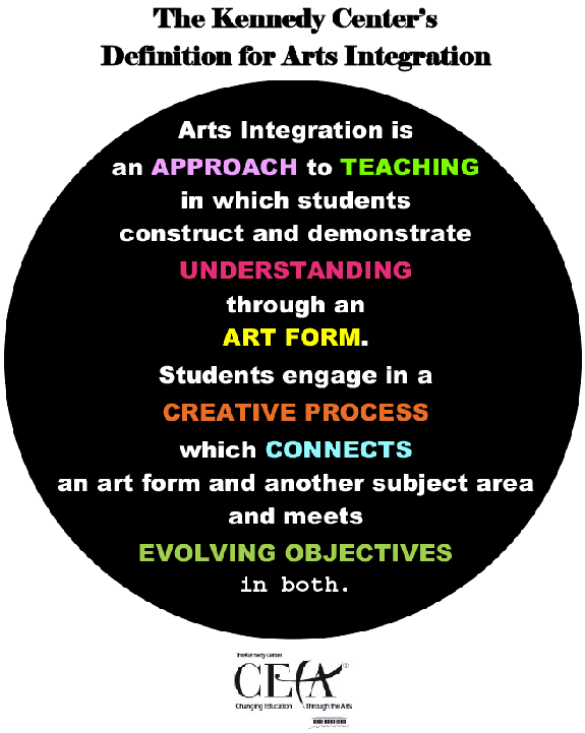

Figure 1 showing the Kennedy Center's definition of arts integration.

The Kennedy Center uses the term "arts" to refer to theatre, dance, music, and the visual arts. For the sake of time and clarity, this thesis research will only focus on aspects of integrating

[17] Silverstein and Lane. "Defining Arts Integration," *The Kennedy Center Changing Education Through the Arts* (2010).

visual art. The article posits that many teachers confuse arts integration with any inclusion of the arts in the classroom, and provides a checklist for teachers to ensure their approach is fully integrated.[18] According to Silverstein, there are six learning principles in arts integration that align beliefs and approaches to teaching: learning is actively built/constructed, experiential, reflective, evolving, collaborative, and involves problem solving. With the belief that learning is actively built/constructed, students discuss and examine what they already know, understand, and believe as the beginning of their learning experience; engagement here is highly personal. With experiential learning, students engage in hands-on activities supplemented by primary sources; they experience and learn through real world challenges and demonstrate learning through visual and kinesthetic methods. Reflective learning is when students engage in regular oral, written reflections on what they learned and how they learned, and also exploring what it means to them; assessment is part of the learning experience. The idea that learning is evolving conveys that learning is marked by cycles; students return to ideas to expand and explore them and see mistakes as part of the learning process. Collaborative learning is when students work in groups and learners depend on each other's thinking to enrich their understanding and construct meaning. Lastly, the belief that learning is problem-solving involves practice where students create their own solutions; students make choices and evaluate the results. Questions have more than one right answer, and students are supported with regular encouragement.[19]

Though this research falls under the formal umbrella, it still gives much insight into how arts integration is currently being defined. The work The Kennedy Center has done with schools is vital to the comprehension and practice of arts integration, and serves as a current framework for many formal and informal educators alike. From this study, and over a decade worth of

[18] See Appendix D
[19] Ibid.

efforts the Kennedy Center has done to clarify arts integration principles, the researcher construes that the definition of arts integration provided by the Kennedy Center is currently the most developed and should be adopted by both formal and informal educators. Through their online collection of resources, the Kennedy Center explores the what and why of arts integration, providing various examples of arts integration practices, as well as the Kennedy Center's arts integration program in schools.

Preparing Educators for Arts Integration is a resource in which members of the Arts Education Partnership (AEP) examined arts integration approaches from across the United States and contributed their research and statewide models to better prepare educators in practice. In the Introduction, Gene Diaz and Martha McKenna note that there are many claims around the uniqueness and impact of arts integration in formal settings; they go on to say that the reader will find many different meanings and interpretations of arts integration among the programs and approaches described in the book, stating clearly that "we do not seek to define the field, but to illuminate it with a broad spectrum of perspectives and programs, identifying promising practices for teacher professional development programs in arts integration."[20] The book is divided into Parts to provide readers with several ways to enter into the arts integration dialogue. The review of literature comes from Part 1, Chapter 1 in which Diaz and McKenna explore different learning theories and its relationship to practices of arts integration. The authors acknowledge that practice in arts integration requires familiarity with constructivist pedagogy, in which "students *construct* as opposed to *acquire* new knowledge."[21] They also introduce the concept of creative process as pedagogy, suggesting that a creative process includes the

[20] "Introduction," In *Preparing Educators for Arts Integration*, ed. Gene Diaz and Martha McKenna, (New York: Teachers College Press, 2017), 6.
[21] Gene Diaz and Martha McKenna, "Theory and Practice in Arts Integration," In *Preparing Educators for Arts Integration,* ed. Gene Diaz and Martha McKenna, (New York: Teachers College Press, 2017), 17.

following four broad components: a safe environment, imaginative exploration, design and construction, and critique.[22] While the book does not give a general definition of arts integration, it is nonetheless important for it gathers multiple perspectives of professionals throughout the United States, offering diverse theory and practice.

Christine Liao writes about the differences between STEAM and arts integration, and notes that the National Art Education Association recently defined STEAM as "the infusion of art and design principles, concepts, and techniques into STEM instruction and learning."[23] From this definition, one could conclude that discussing the same content and ideas (arts integration) under a different term (STEAM) could cause confusion. Silverstein's definition of arts integration stated previously recognizes the importance of creativity and hands-on learning through art making. Liao suggests that educators position STEAM education along the lines of arts integration due to its long-established beneficial strategies compared to STEM, and that creation/production is essential for educators focusing on STEAM. Though the author recognizes these confusions, there still seems to be no consistent conclusion on what to do about these varying definitions. However, there still seems to be a general consensus that an arts-integrated approach to STEAM can equip students with more interdisciplinary experiences that contribute to a more innovative and creative society.

In the literature, there appear to be many terms used to describe the connection between art and STEM, including interdisciplinary, Arts-based Learning, STEAM, Art Inquiry, Art Enhancement, etc. From the current research it can be concluded that many believe arts integration can be used to *support* STEM learning. Recognizing the importance of integrating

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[22] Ibid.
[23] Christine Liao, "From Interdisciplinary to Transdisciplinary: An Arts-Integrated Approach to STEAM Education," *Art Education* 69, no. 6 (October 2016): 44-49.

science and art disciplines is abundant, but there needs to be a clear agreement on what exactly arts integration is, and how that differs from STEAM.

Literature Review: Efforts to Support

On September 15–16, 2010, a joint meeting between the National Science Foundation (NSF) and the National Endowment for the Arts (NEA) was held, bringing together 55 leaders and stakeholders, including artists, scientists, engineers, and practitioners who "straddle disciplinary boundaries."[24] The main goal of this meeting was to explore commonalities, foster collaborations, and develop a set area of interest for connecting arts with other disciplines. This produced a series of conclusions that reflected the participants' needs and views. Firstly, fundamental concepts of the arts and sciences *must* be mutually respected. Secondly, Disciplines should reinforce one another, not detract from each other. There is a *need* for shared terminology and concepts. STEAM learning outcomes need to be identified. Finally, collaboration is vital in advancing interdisciplinary research. Since this meeting, the NSF, NEA, and National Endowment for the Humanities started a partnership to begin formally exploring how these organizations can work together at the intersections of art and science and the humanities.[25]

Research from STEAM Connect identifies the specific trend called STEAM as the integration of arts into STEM learning. The STEM to STEAM initiative is intended to add areas of art and design to the national agenda of STEM research and education in America.[26] STEAM Connect provides a forum for community collaboration and a collection of resources to bring a diverse group of stakeholders together to address common objectives that include broadening the

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[24] D. Fox Harrell and Sneha V. Harrell, "Strategies for Art + Science + Technology Research," *Executive report on a joint meeting of the National Science Foundation and the National Endowment of the Arts* (2010).
[25] Ibid., 14-15.
[26] STEAM Connect (n.d.) *What is STE[+a]M?* Retrieved from http://steamconnect.org/steam/.

utility of STEAM through cross-discipline collaborations, and increase community awareness of and investment in STEAM. STEAM Connect is dedicated to bridging arts, science, education and the community, stating that "in a rapidly changing world, we all must become well-rounded global citizens who have the imagination and skills to conquer new challenges, and STEAM is the catalyst for this."[27] The forum is useful for all types of professionals interested in current STEAM initiatives and projects, providing multiple resources and connections in the field.

In 2011 the NSF funded a two-day workshop at the Rhode Island School of Design (RISD) titled "Bridging STEM to STE(A)M: Developing New Frameworks for Art/Science Pedagogy." The goal of this workshop was to develop an innovative educational agenda that forges the relationship between art and design disciplines and STEM. Experts in science, the arts, technology, and educational research met to discuss how bridge STEM with creative processes. The goals of this workshop were to develop strategies for enhancing STEM education with arts integration, and to build new connections between art disciplines and scientific fields.[28] It is clear that artists and designers have the ability to make significant contributions when it comes to meeting the challenges of 21st century education practices, and funding for workshops where these collaborations can take place are vital.

Literature Review: Arts Integration and STEAM Practices in Museums

Arts integration continues to grow in the museum field as well; however, there appears to be little documentation on arts integration practices. Regardless, there are examples in this review that denote the shift in the museum field concentrating on arts integration. There are

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[27] Ibid.
[28] "Bridging STEM to STEAM: Developing New Frameworks for ART/SCIENCE Pedagogy." *National Science Foundation Workshop*, (2011), https://www.nsf.gov/awardsearch/showAward?AWD_ID=1046705.

many ways in which arts are integrated into STEM learning in museums, the first example being the Exploratorium in San Francisco. The Exploratorium emphasizes that the arts are fundamental to discovery and understanding the world. The institution has a unique mission that stresses its purpose as a "public learning laboratory exploring the world through science, art, and human perception."[29] The Exploratorium was founded in 1969 by physicist Frank Oppenheimer and operates as a museum of art, science and human perception, where art plays a central role in shaping their approach to learning.[30]

On March 3–4, 2011, the Exploratorium held a conference titled "Art as a Way of Knowing." The conference gathered some 125 artists, scientists, and educators to explore the history, practice, and value of the arts as a means for examining the world around us. The two days consisted of presentations, discussions, performances, and round table conversations about art as a method of inquiry and way of knowing.[31] A clear starting point for the conference was to "move beyond the discussion about similarities, differences, or complementarities between art and science," and instead learn "how the arts expand our engagement and understanding of the natural and social worlds."[32] The premise of Art as a Way of Knowing was based on the idea that learning in and through the arts is engaging with the questions of the world, formulating ideas, and deepening knowledge. The conference was structured into three main components: exploring art as a form of inquiry, understanding lesser known histories of art, science, and education, and surveying the contemporary landscape. Participants at the conference pointed out that over the two day discussions "there seemed to be a gap between the current understanding of the nature of

[29] "About Us: Mission, Vision, and Values," Exploratorium, accessed August 12, 2018, https://www.exploratorium.edu/about-us.
[30] "Art as a Way of Knowing," Exploratorium, accessed November 10, 2018, https://www.exploratorium.edu/knowing/index.html
[31] Marina McDougall, Bronwyn Bevan, and Robert Semper, "Art as a Way of Knowing," San Francisco, (March 2011): 3-4.
[32] Ibid., 6.

learning as participatory and inquiry-based, and the way in which science is commonly presented and experienced in systems of education, in particular informal learning."[33] There were many powerful examples shared at the conference where arts-infused engagements with the natural and social worlds have flourished, but the approaches are rarely found in representations of teaching and learning science. Ultimately this conference suggests a need for growth and transformation in the field of informal science education and emphasizes how important this transformation is in a radically transforming world.[34]

In terms of arts integration in museums, Molly L. Kelton observes and writes about an interdisciplinary professional development program that involved museum practitioners collaboratively exploring and designing visitor programs and exhibits that blend mathematics, science, and the arts. Kelton refers to the program as a STEAM Professional Learning Lab. It consisted of bi-monthly three-hour workshops over an eight-month period. The Lab contributed to the design of two STEAM exhibitions along with public programs, and resulted in significant professional growth among participating museum staff.[35] In conclusion, Kelton notes that when collaborating, museum partners should "consider how future institution-level priorities intersect with cross-disciplinary initiatives."[36] The author also suggests that playing a sort of "cross-disciplinary" game of catch could serve as a useful metaphor for other museum educators pursuing STEAM-related projects. This research is noteworthy because not only does it focus on exhibits and programs related to arts integration and STEAM, but it also emphasizes the importance of forming museum partnerships for sustained growth.

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[33] Ibid., 32-33.
[34] Ibid., 34.
[35] Molly L. Kelton, and Patti Saraniero, "STEAM-y Partnerships: A Case of Interdisciplinary Professional Development and Collaboration," *Journal of Museum Education* 43, no. 1 (2018): 55.
[36] Ibid., 63.

The final case study is on the "Art of Looking" program launched in 2012 by the Barnes Foundation in Philadelphia. This is a STEAM–based program for 5th and 6th grades in the School District of Philadelphia that focuses on the connections between art, science, and math. The case study focuses on the studies and improvements made for this program to better address STEAM principles and to make stronger curricular connections between disciplines, but grounded in art. The Barnes invited participants with expertise in arts education, science, and math to play key roles in the optimization of this program. The educators involved went through several iterations of the program to make it more effectively connected to STEAM learning. Revealed in the study are suggested drivers for improvement and a set of STEAM design principles. Through the revision process, the study concluded that the primary objective in this program should be to "engage students in art analysis *complemented* by relevant mathematical and scientific practices, with art making as secondary goal to demonstrate student understanding."[37] This case study is important in the research for this thesis because it is an example of contemporary museum programming that shows what successful arts integration and STEAM standards look like in practice.

[37] Glass and Wilson, "The Art and Science of Looking: Collaboratively Learning Our Way to Improved STEAM Integration," *Art Education* 69, no. 6 (2016): 8-14.

Chapter 3: Methodology

Introduction

The lack of clarity among professionals regarding what these terms mean and what they look like in practice was apparent in the Literature Review chapter of this thesis. This qualitative study was designed to gain a better understanding of the way in which current professionals are defining the terms arts integration and STEAM, and to determine what their institution is currently doing to implement these efforts. Along with extensive research on the past and current literature, this thesis intends to define the current state of arts integration in museums and explore its relationship to STEAM practices by interviewing art and science professionals from both formal and informal institutions. The ultimate goal is to bring clarity to arts integration and STEAM by providing a framework for educators to understand what these terms mean and what they look like in practice. Once these clarifications are made and definitions are established, this thesis will present a few examples of current efforts in which arts integration or STEAM practices are being implemented in informal settings, whether through educational programming, professional development workshops, teacher resources, conferences, or other means.

Setting

To obtain an accurate assessment of how current professionals are defining arts integration and STEAM and what they are doing at their institution, this thesis conducted qualitative research consisting of semi-structured, one-on-one interviews. There were two methods used in gathering this information: phone interviews with guided questions (see Appendix B) and a fillable PDF with the same questions sent out to those who could not be reached via phone. Since not all of these professionals are local to Philadelphia, phone interviews

were the best option to gain valuable information. The PDF was sent out to those who did not have time for a phone interview, thus their answers are shorter and more succinct. The setting includes art museums and science museums to gain a better analysis of how these words are being defined.

Participants

The total sample size for this research method is fifteen participants. The sampling procedure for this research was that of convenience. Individuals were selected intentionally by the researcher when searching for active arts integration and STEAM programs, but some were also referred to by others. Potential participants were contacted and asked to take part in a short interview and those who responded were chosen for the sample. To maintain balance, participants were chosen in both art and science fields, and from cultural institutions as well as K-12 schools. It was important not to make the interviews exclusive to those local to Pennsylvania and to gather a broader understanding of these practices. Therefore, professionals from institutions in North Carolina, Seattle and Maryland are included among the participants. Participants also vary in job title at their institution; however, all have experienced some type of arts integration or STEAM, and/or have opinions on how to define the terms in practice. The researcher notes that museum participants had varying job titles and that this may in some way effect their overall understanding of the terms arts integration and STEAM.

Participant	Discipline / Institution	Job Title
Participant 1	Art / Museum	Project Manager NCMA Connects
Participant 2	Art / Museum	Manager of Gallery Learning and Interpretation
Participant 3	Art /Museum	K-12 Programs Manager
Participant 4	Science / K-12 Teacher	Math and Science Teacher
Participant 5	Science / Museum	Art and Accessibility Coordinator
Participant 6	Science / Museum	Education Manager
Participant 7	Science / Museum	Exhibition Designer
Participant 8	Science / Museum	Professional Development and Outreach Initiatives Coordinator
Participant 9	Art / K-12 Teacher	Lower School Visual Arts Teacher
Participant 10	Science / Museum	Manager of Early Childhood Initiatives
Participant 11	Art / Museum	Head of School and Teacher Services
Participant 12	Art / Museum	Museum Educator
Participant 13	Art / K-12 Teacher	K-8 Art Teacher
Participant 14	Science / Museum	Professional Development Program Manager
Participant 15	Art / Museum	Curator of Education and Public Programs

Table 1. Showing participants Discipline, Type of Institution, and Job Title.

Instrument

For this qualitative method of informal interviewing, an instrument was prepared as guide to ensure specific questions were being addressed. This process was selected so that participants could elaborate on a specific topic if desired, while giving their own definitions and opinions on

the subject at hand. Since arts integration and STEAM are somewhat abstract terms, it was important to understand *how* professionals are defining them in their own words, and *how* they believe they are implementing them at their institution.

There were eight guided questions, intentionally in a particular order to allow flow to the conversation. The first three questions were basic demographic questions, asked to determine full name, job title, and current institution. The following two questions were asked to determine the participant's own opinions on the definition of arts integration and its relationship to STEAM practices. The last three questions were aimed at education professionals who are practicing arts integration and STEAM at their institution, to find out if they used any sort of framework when developing or implementing the program. The researcher believed these questions were not as relevant to those participants whose job title did not involve education; however, their interpretations remain valid because the respondents are a part of an institution that understands the importance of arts integration and STEAM. There were some instances where the participant assumed the language of STEM inherently in their responses. This type of response is important in understanding how their institution is using a certain language and how they are relating that language to what they consider to be arts integration.

Procedure

Phone interviews were recorded on an iPhone using the iRec app during the conversation to ensure that the researcher could go back when necessary to transcribe, while also taking notes during the conversation. The fillable PDF with the same questions was sent out to participants who could not be reached by phone. These responses are typically shorter due to the nature of the way the survey was administered. Interviews were conducted between the months of July and

October, while PDFs were sent out in September and October. Interviews were transcribed by the researcher and later coded to determine common patterns and themes within certain answers.

Data Analysis

Once the interviews were transcribed, each participant's answers were entered into an Excel spreadsheet to organize the answers by participant. All questions and answers were then entered into a document so that naturally occurring themes could easily be identified. Particular phrases and words were highlighted for reference when quoting the participant. All themes were developed from a coding process that specifically aligned with the research of this thesis. Codes were created to easily group responses into a general answer, enabling the researcher to understand and classify the many different ways participants responded to each question. Themes that emerged while analyzing the responses are Type of Institution, Discipline, Definition, Relationship, Approach, and Skills Highlighted, all of which will be discussed further in the following chapter along with the corresponding codes.

Type of Institution	K-12 School vs. Museum (Formal vs. Informal)
Discipline	Science vs. Art
Definition	How participants define arts integration
Relationship	How participants configure the relationship between arts integration and STEAM and if terms are interchangeable
Approach	How participants approach these terms in practice
Skills Highlighted	Types of skills highlighted through programming

Table 2. Showing suggested themes with explanation.

Chapter 4: Presentation of Data

Themes and Patterns

The following themes were a direct result of analyzing qualitative interviews on the following subjects relating to arts integration and STEAM: Discipline, Type of Institution, Definition, Relationship, Approach, and Skills Highlighted. Types of programming mentioned will be briefly touched upon before a short review of programs. The distinct themes of Discipline and Institution will remain a common thread throughout the analysis of this study. Definition refers to how current professionals are generally defining the term arts integration. Relationship refers to how they see or understand its relationship to STEAM, and if they see the terms as interchangeable or not. Approach refers to how these professionals are approaching arts integration or STEAM in their own institution, whether it is through the primary lens of art or science. Skills Highlighted exemplifies the emphasis placed on the different types of skills students are gaining from these types of programs. Lastly, this chapter will conclude with the types of programming mentioned in the interviews (specifically what the museum participants mention their institution offers as a STEAM or arts integration program), followed by a short review of these programs from the researcher to further validate and support the findings.

Discipline and Type of Institution

The sample size of fifteen reflects a broad group of professionals in both science and art related disciplines. With 53% working within the realms of art and 47% in a science-related field, this equal division was important in order to gather perspectives on both sides of the spectrum. This thesis is focused primarily on how museum professionals are defining terms

related to STEAM; however, gathering insight from those who teach in a K-12 setting was also important. The results of the interview collection reflect 80% of those who work in a museum institution, and 20% K-12 teachers. Eight out of twelve museum professionals worked in art-related disciplines, while two out of three K-12 teachers taught visual arts.

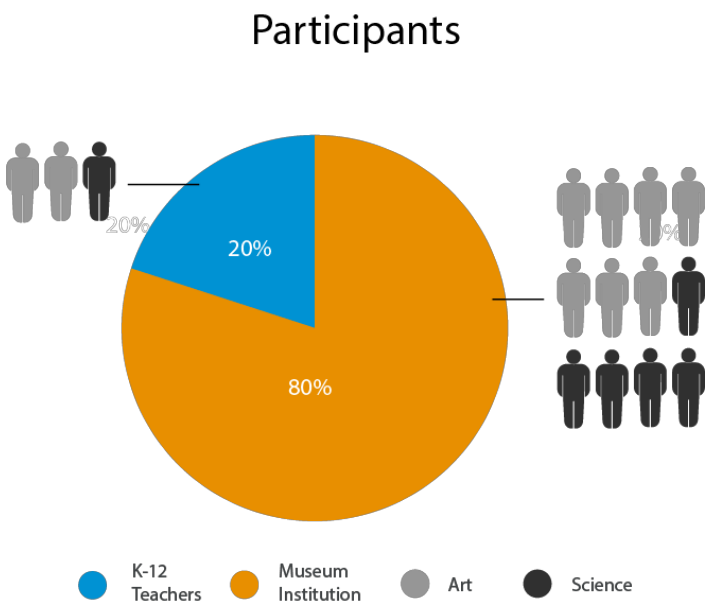

Figure 2. Pie chart showing participants type of institution and discipline taught.

Defining Arts Integration and STEAM

To help clarify how professionals are defining arts integration and its relationship to STEAM, the following questions were asked to the participants: "How would you define the term arts integration?" and "Do you believe there is a difference in definition or approach between arts integration and STEAM?" From these questions, themes of Definition, Relationship, and Approach surfaced. Responses under Definition were coded as "Arts integration is an interdisciplinary approach to teaching," in which participants refer to integrating the arts into multiple subjects. "Arts integration is integrating the arts into STEM," where

participants viewed the term as integrating art into STEM subjects to create STEAM, and "Adopted the Kennedy Center's definition of arts integration," in which participants specifically stated where they got their definition.

When asked, "How would you define the term arts integration?" 69% of participants implied that to their understanding it is a type of interdisciplinary approach to teaching different subjects; some either used the term "interdisciplinary" or the phrase "interdisciplinary learning" as used by Participant 9 who explains arts integration as "the educational approach where the arts are used as integral points of departure in learning. I have also heard this referred to as "interdisciplinary learning."[38] "Interdisciplinary" is a key term found often within the research of arts integration. Merriam-Webster defines "interdisciplinary" as involving two or more academic, scientific, or artistic disciplines.[39] A more in depth definition comes from The Arts Education Partnership who defines "interdisciplinary education" as "education that enables students to identify and apply authentic connections between two or more disciplines and/or to understand essential concepts that transcend individual disciplines."[40] Along the same lines, Participant 12 explains arts integration as "using art as one of the tools and techniques to build skills to hone in on a curriculum that teachers are already doing," but goes on to explain further that arts integration includes "various aspects of math, science, social studies, and language arts. Visual arts and beyond can be used in conjunction with all of that."[41] Participant 2 agrees that arts integration is "ways to pull in art in other lessons and disciplines," and goes on to clarify "you don't hear the term arts integration much out of formal education. This term is broader and

[38] See Appendix B
[39] https://www.merriam-webster.com/dictionary/interdisciplinary
[40] Arts Education Partnership "Creating Quality Integrated and Interdisciplinary Arts Programs," September 2002.
[41] See Appendix B

more holistically integrated whereas STEAM applies more to singular programs."[42] Participant 13 states, "When I hear arts integration I'm thinking more about art lessons being integrated into core academic classes; for example, a math teacher using geometric art in their classroom to teach measurement and vertices and stuff like that. I see it as art being utilized to reach all learners in a core class."[43] Not every participant under this category used the term "interdisciplinary" explicitly, but understood to some extent that the approach to arts integration is indeed interdisciplinary.

Only one participant viewed the definition in line with integrating the arts into a STEM subject. For example, Participant 8 states, "In terms of STEM, I would define arts integration as teaching a STEM concept through an art form, or using an art form as the mechanism to introduce the STEM concept."[44] Through this definition, it is clear the participant sees arts integration as simply integrating the A into STEM to make STEAM.

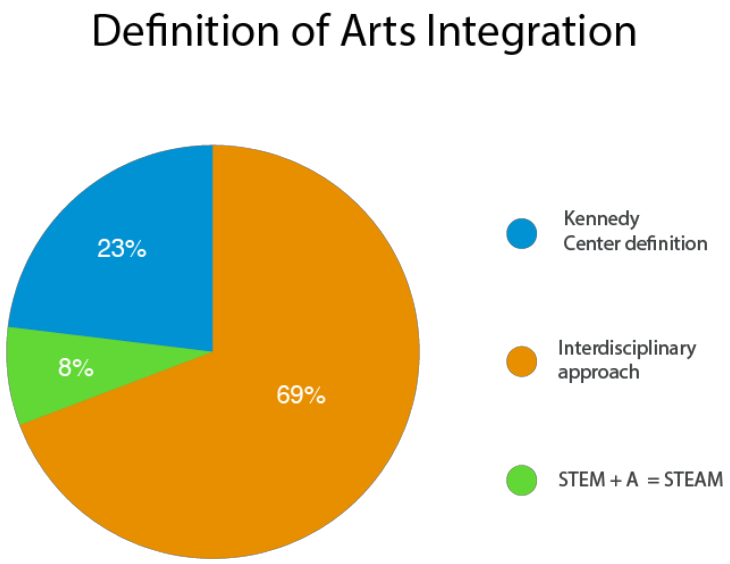

Figure 3. Pie chart showing the breakdown of how participants define arts integration.

[42] See Appendix B
[43] See Appendix B
[44] See Appendix B

Interestingly, 23% of participants went further to actually adopt the Kennedy Center's definition of arts integration as their own. As iterated earlier in this thesis, the Kennedy Center defines arts integration as "an approach to teaching in which students construct and demonstrate understanding through an art form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both."[45] Due to the Kennedy Center's credibility explored in the literature review section of this thesis, this definition is essential in clarifying and developing a framework for what arts integration means for current and future professionals. Participant 11 defines arts integration as "a meaningful integration of arts into the entire curriculum." They continue, "To be more specific, I think the Kennedy Center's definition makes the most sense and I try to adhere to it."[46] Similarly, Participant 1 also states:

> We believe in the Kennedy Center's definition that arts integration is an approach to teaching and learning in which the arts and another subject area are taught together with the intentional purpose to make connections, foster creative and critical thinking and develop awareness of multiple perspectives. At the NCMA, works of art are used as both a catalyst and bridge to help teachers and students see and articulate how ideas and topics connect. Works of art provoke discussion, inspire writing and spur students to create their own art.[47]

While most participants agree that arts integration is an interdisciplinary approach to teaching many subjects, the following section is important in determining how participants see this term in relation to STEAM.

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[45] Silverstein and Lane. "Defining Arts Integration," *The Kennedy Center Changing Education Through the Arts* (2010).
[46] See Appendix B
[47] See Appendix B

Relationship Between Arts Integration and STEAM

While a general understanding of the term arts integration is evident from the data acquired, the use of language when it comes to the relationship between arts integration and STEAM is still inconsistent. Some participants who recognized that arts integration is an interdisciplinary approach to teaching also believe that the term is synonymous with STEAM or that they are one in the same. To gauge how professionals viewed this connection, participants were asked "Do you believe there is a difference in definition or approach to between arts integration and STEAM?" It was clear that the way people were identifying the relationship between these terms had an effect on their overall understanding. The theme of Relationship revealed the following codes: "Arts integration and STEAM are one and the same," "Arts integration and STEAM support each other," and "Arts integration and STEAM are *not* interchangeable." Participant 5 believes arts integration and STEAM to be identical, stating that "I guess without knowing exactly how the Philadelphia School District is defining them I would say it's pretty interchangeable here."[48] Similarly, Participant 8 states, "I don't see a large difference between the two. I'd imagine that arts integration would apply outside the realms of STEM and STEAM (in teaching literacy or social sciences for example)."[49] It is important to note that these two participants are educators in a type of science institution that typically holds programs relating to STEM subjects.

Participant 12 is unique because while they understand the relationship between STEAM and arts integration as one of support, they claim that "arts integration can be found in STEAM, and I think one informs the other; I think of it as a square within a rectangle. STEAM is arts

[48] See Appendix B
[49] See Appendix B

integration, but it's also this separate unique thing."[50] While this participant sees the terms under the same umbrella, they still recognize in some sense that arts integration has its own approach. Participant 3 makes the same assessment regarding Relationship, positing that arts integration is "an umbrella term in which STEAM sits under as a type of arts integration."[51] This pattern is prevalent in the data analysis, as Participant 7 also believes in this type of relationship and makes the same analogy of an umbrella, envisioning arts integration as "an umbrella term that encapsulates STEAM and experiential learning."[52]

While a basic understanding of the supportive relationship between these two approaches is apparent, the most interesting responses were those that were coded into "Arts integration and STEAM are *not* interchangeable." Above, the researcher noted that 23% of participants adopted the Kennedy Center's definition of arts integration. Two out of three of those participants also firmly believe that the terms are not interchangeable. Participant 1 comes from an art museum in North Carolina, and believes that in terms of the relationship between arts integration and STEAM:

> STEAM is a bit more elusive. When we've defined STEAM we've used the Science, Technology, Engineering, Art and Math definition for the acronym even though there are so many other approaches. We do not consider them the same thing. We feel arts integration can include more subject areas and sometimes STEAM does not actually integrate the arts as authentically as arts integration does.[53]

[50] See Appendix B
[51] See Appendix B
[52] See Appendix B
[53] See Appendix B

This response is important because not only does the participant not consider them the same thing, they also believe that STEAM may not always do a good job in fully integrating the arts. This is not the only participant who feels this way, as Participant 15 also believes that in STEAM, "the arts are sidelined," and they have "rarely seen that art is a real part of the STEAM conversation."[54]

Participant 11, also from an art museum, states, "I'm not even sure I believe they support each other; they are very different." They go on to explain that their museum has even adopted their own definition of STEAM as "the purposeful integration of science, technology, engineering, arts, and mathematics education. STEAM teaching and learning emphasizes process over product and empathy through the use of design thinking, real-world application, student collaboration, and interdisciplinary connections."[55] This participant was very clear that there is a distinction in terminology, and that their institution has a complete understanding of this difference, as they have adopted their own definitions. It could be stated that the very act of an institution adopting a definition as their own, based on research, would be beneficial in establishing a common framework.

Approaching Arts Integration and STEAM

How participants are approaching these terms in their own practice is just as important as how they are defining them. It is prevalent in the collection of interviews that most participants believe arts integration focuses on teaching other subjects through arts, or in this case, specifically visual art, whereas STEAM typically approaches teaching through a science-first point of view. Codes that emerge from this suggested theme are "Science as the primary

[54] See Appendix B
[55] See Appendix B

approach," "Art as the primary approach," and "Arts are embedded naturally." These codes refer to how participants believe the arts are approached while teaching. While some viewed either art or science as the primary approach to teaching a subject, others viewed the arts as being naturally imbedded in their everyday curriculum. Participant 10, categorized under the science Discipline, feels that "STEAM is approached more from a science first point of view whereas arts integration focuses more on the arts as the primary approach,"[56] as illustrated in Figure 4. Similarly, as seen before in the Definition section of this analysis, Participant 9 believes that in arts integration, art is the *primary point of departure* when teaching and learning other subjects, as illustrated in Figure 5.

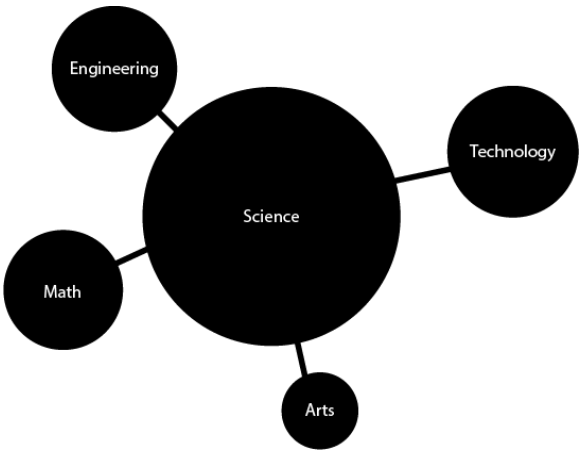

Figure 4

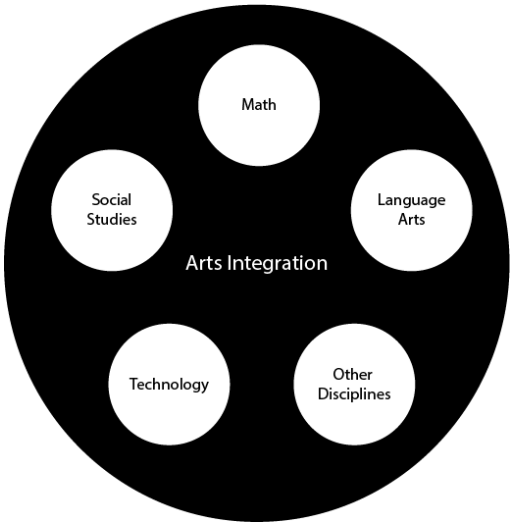

Figure 5

Interestingly, two of the three K-12 schoolteacher participants who were interviewed, fell under the code "Arts are embedded naturally." Participant 4 teaches math and science to high school students, and mentions that in their classroom "It's all STEAM. It's part of what they do. If you're doing a good job of teaching STEM then it's hard to separate out the art and the design.

[56] See Appendix B

It's there, it's one of the fundamental elements of STEM."[57] Participant 9, a K-8 visual arts teacher passionately states, "Honestly, I don't care for labels. If you are doing this right then you are naturally weaving many different subject areas into your lesson. As I research and present a lesson, I weave different subject areas into the context of the lesson introduction/demonstration."[58] From these responses, it is evident that these participants agree that arts are embedded naturally in their classroom teaching.

Skills Highlighted

In 2009 the Common Core State Standards (CCSS) was launched by state leaders, governors, and state commissioners of education from forty-eight states. The CCSS website states "the Common Core State Standards provide a consistent, clear understanding of what students are expected to learn…reflecting the knowledge and skills that our young people need for success in college and careers.[59] Many skills are reflected throughout CCSS in both math and english language arts/literacy; skills such as collaboration, communication, problem solving, critical thinking, and research skills.[60] The major skills highlighted in CCSS are also many of the same skills highlighted by participants when talking about arts integration or STEAM programs. It is essential to note that these types of museum programs can help emphasize the skills reflected from CCSS.

Many participants mentioned the same skills highlighted when talking about both arts integration and STEAM; reviewing these skills are important because they will help other educators understand the types of skills that could be strengthened as a product of using these

[57] See Appendix B
[58] See Appendix B
[59] "Understanding the Skills in the Common Core State Standards," Achieve, December 2012, 2.
[60] Ibid.

approaches, and reiterate them in their own classroom. Skills Highlighted was divided into the following categories: "Design Thinking," "CER Claim-Evidence-Reasoning," and "Problem Solving." Though these categories all involve a form of problem solving, the process varies in each method, as well as the way in which participants talk about it. Here, "Problem solving" is used as a general term while the other categories include distinct methods of problem solving.

In this thesis, design thinking is defined as "a mindset which alternates between divergent and convergent thinking, which engages both the analytical and creative mind at different times throughout the process."[61] Participant 11 adopts methods of design thinking from their own research stating "we looked at Stanford d.school's design thinking process[62] to develop our STEAM program. We use this design thinking process in all of our tours, workshops, and professional development seminars." They continue: "The STEAM program must use the design thinking process and it must include creative problem-solving and collaboration."[63] It is important to note that this participant is the same participant from the previous sections who adopted their own definition of arts integration and STEAM, and who also firmly believes the terms are not interchangeable. Participant 14 also mentions Stanford d.school's design thinking process when talking about skills highlighted in their STEAM program. They have looked at multiple frameworks for reference when developing their programs, which more educators could benefit from.

The next code discussed is CER, which refers to Claim, Evidence, and Reasoning. This is an explanation that consists of a claim that answers the question, evidence from students' data, and reasoning that involves a "rule" or scientific principle that describes why the evidence

[61] Mike Bruckner, "Human Centered Design in the K-12 Classroom," Eduspire, April 27, 2018. https://www.eduspire.org/technology-blog-for-teachers/human-centered-design-k-12-classroom/.
[62] Stanford d.school, "A Virtual Crash Course in Design Thinking," https://dschool.stanford.edu/resources-collections/a-virtual-crash-course-in-design-thinking/.
[63] See Appendix B

supports the claim. Two participants mentioned in some way that through their teaching they employ this method of making a claim, backing it with evidence, and stating a reason. Participant 3 from the Barnes Foundation in Philadelphia mentions using scientific skills when learning about art. They claim that the Barnes identifies the CER method, which is "sort of an updated scientific method in broad strokes," where "students are looking at artworks and looking for evidence— which is anything identified with the senses. Students use evidence to make claims. Reasoning is the bridge between evidence and claim. We use this method a lot when doing our STEAM programs."[64]

Participant 13 is a K-8 art teacher in Philadelphia who frequently takes their students on field trips to The Barnes Foundation for the *Art of Looking* program. They express that their students learned to observe artwork and back up those observations with evidence; the participant mentions "it's a fun connection I like to make in my own classroom because I saw them modeling that at The Barnes." This response emphasizes the importance of museums as a place where all types of educators can learn these skills either through observing what museum educators practice during a tour, activity, or even through professional development workshops.

Participant 15 reiterates the importance of observation, which is an important step before making a claim, as a skill highlighted in their programming. Describing how to facilitate a program for a K-12 audience, they say: "In general the place I like to start is with artful thinking routine (Project Zero's see, think, wonder).[65] Skills I want them to take away from visits are critical thinking, observation, and discussion. Learning how to talk about what they see and back

[64] See Appendix B
[65] Project Zero, "See / Think / Wonder", Harvard Graduate School of Education, 2015, http://pz.harvard.edu/resources/see-think-wonder-at/.

it up is so important."[66] While the participant does not overtly state CER in the interview, the skills mentioned will fall into this code.

A few participants mention problem solving specifically as a skill highlighted through their STEAM programming. In discussing their program, Participant 14 expresses:

> Deep learning is achieved through work on projects where the end product is left somewhat open-ended. In doing this type of work, students must use methods of problem solving by testing/prototyping, and revising. When they reflect on their process, they discover a reason to strive for mastery of skills, confidence in their abilities as creative problem solvers, and the importance of perseverance.[67]

Participant 11 also mentions problem solving as an important skill highlighted for their STEAM program. The program is described as a "two-hour interactive guided tour and hands-on creative problem-solving workshop."[68] By reviewing the skills highlighted it becomes evident that most STEAM programs are project-based and hands-on, whereas arts integration programs can be more inquiry-based, emphasizing the importance of discussion. The following section will be the types of programs mentioned that exemplify an arts integration or STEAM approach.

Types of Programming

Participants were asked about programs held at their institution that focus on STEAM or arts integration. In general there are many different types of programming available offered by museums, all of which are not mentioned here. Some answers will overlap, as there were multiple types of programs mentioned at some institutions. The answers are limited to the twelve participants who are from a museum type of institution. There were only a few types of programs

[66] See Appendix B
[67] See Appendix B
[68] See Appendix B

mentioned in the interviews which fall into: "Professional Development," "Field Trips," "After School," and "STEAM Tours." These categories were pulled from the answers given on specific programs mentioned in the interview process, and are not exemplary of every type of arts integration or STEAM program that may be offered at the institution. Participant 12 reiterates the importance of these types of programs in Seattle, stating, "Washington does not have enough funding for education as a whole. Throughout the state education is in debt. Arts were cut. Therefore, a lot of art education is coming from teaching artists or after school programs, or partnering with other art museums."[69] In some cases, as seen with this participant, the museum is the only exposure to art some students have, therefore it is vital for museums to foster these relationships with schools. It is important to note that all of the programs mentioned are directly tied to K-12 learning.

Professional Development in terms of K-12 education may be used in reference to a wide variety of specialized training, formal education, or advanced professional learning intended to help teachers and other educators to improve their professional knowledge, competence, skill, and effectiveness. Participant 11 mentions, "For arts integration we do professional learning workshops. We believe that the art form (let's say painting) must hold equal importance to the curriculum (let's say science)."[70] Participant 14 also indicates professional development opportunities offered at their institution: "We hold an active U.S. Department of Education grant to provide professional development for teachers to incorporate science and technology in their standards-based visual arts classes."[71] It is vital for museums to offer professional development programs because this ultimately is what extends the relationship between informal and formal education practices. Participant 1, for example, states:

[69] See Appendix B
[70] See Appendix B
[71] See Appendix B

> For STEAM we offer online mini courses through the NCMALearn website along with many lesson plans for teachers. These programs provide educators with quality professional development, which is lacking in our state. We provide educators with relevant and practical experiences to help them better engage learners. These programs continue to make museums a relevant cultural resource for both teachers and students.[72]

Two participants mention STEAM-related field trips offered at their institutions. Participant 12 references a program in which students take a field trip to the museum's sculpture park and engage in a tour and art-making activity led by a teaching artist in which they explore nature and practice observation skills. The other, Participant 1, mentions virtual field trips connecting to STEAM-related topics in which teachers and students can join the art museum live from all the galleries. In this program students "practice scientific inquiry while engaging in works of art in the collection."[73]

After-school programs are usually offered by museums to provide activities for youth to participate in outside normal school hours. These programs can often offer academic support or enrichment in school-related subjects. Participant 6 notes an after-school program at their institution where "we send museum educators into local middle schools and do an hour of STEAM after-school programs."[74] Participant 14 also mentions an after-school STEAM program that is "designed to increase interest in STEAM concepts and STEAM careers through fun, hands-on, and creative activities that incorporate visual arts projects."[75]

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[72] See Appendix B
[73] See Appendix B
[74] See Appendix B
[75] See Appendix B

Participant 11 mentions STEAM tours held at their institution stating "We have a STEAM tour and workshop for students. We see about 55,000 students a year. About 8,000 of them will go through the STEAM program. It's a two hour interactive guided tour and hands-on creative problem-solving workshop."[76] A short review of programming mentioned by participants relating to arts integration and/or STEAM will be addressed in the following section. Not all programs offered will be mentioned. The idea is to get a general idea of how these programs support the findings.

Review of Programs

North Carolina Museum of Art

The North Carolina Museum of Art (NCMA) in Raleigh offers many educational programs relating to arts integration and STEAM. As for programs related to STEAM, there is currently a professional development opportunity for educators to take online mini-courses on art and science. This program is offered over the summer months. Participants explore topics through inquiry-based learning in an online community while gaining valuable classroom connections. Each course is divided into three sections: *Explore the Topic, Try Something New*, and *Share What You Think*. In *Explore the Topic*, educators are introduced to new concepts, tools, and works of art to stimulate thinking and help them begin making connections between art and science. In *Try Something New*, educators are asked to deeply engage with the content and are introduced to an artistic process. The *Share What You Think* section is sharing reflections and classroom ideas with course colleagues so that educators can maximize the benefits they receive from the course. Course goals are to explore topics through the lens of an artist and a

[76] See Appendix B

scientist, and learn strategies for integrating art and science into school curriculum. Course topics include Art and Science of Looking, Art and Systems, Art and Physics, and Art and Ecology. The Art and Science of Looking course for example emphasizes observation and perception, with a goal to help educators and students harness the power of observation in absorbing science concepts through inquiry-driven, art-based practices. As for arts integration, NCMA's Fellowship for Collaborative Teaching offers yearlong support in arts integration strategies to North Carolina educators. Participating teachers become part of a collaborative community, attend on-site and online professional development sessions, and plan and implement integrated lessons in their classroom.[77]

The High Museum of Art

The High Museum in Atlanta, Georgia offers a STEAM tour and workshop for grades K-8; in this program students discover firsthand how artists are creative problem solvers and thinkers. Museum educators use the museum's collection as evidence for creative problem solving. Students learn directly from the objects, observing how artists discover complex problems and find innovative solutions, and create their own art. The tour is organized into four categories: Resources and Nature, Design and Structure, Light and Color, and Shapes and Patterns. The program offers resources for teachers including a STEAM pre-tour PowerPoint, and workshop lesson plans for both elementary and middle school. Through this program, The High Museum engages students and educators in the artistic process and promotes the skills necessary to build twenty-first century learners.[78]

[77] "Online Mini-Courses on Art and Science," NCMA Learn, https://learn.ncartmuseum.org/events/artandscience/.
[78] "STEAM Tour and Workshop," The High Museum, https://www.high.org/tour/steam-tour-and-workshop/.

Da Vinci Science Center

The Da Vinci Science Center in Allentown, Pennsylvania offers a STEAM TEAM summer camp, which an innovative summer camp that focuses on bringing STEAM into their region. The Da Vinci Science Center partnered with The Baum School of Art in Allentown, PA to bring STEAM education to life in this collaborative summer camp program. The camp program highlights the connections between science and the arts with days packed with hands-on activities, creativity and discovery. Students spend their mornings at the Baum School of Art, and their afternoons at the Da Vinci Science Center working on creative projects. Activities include explorations into a variety of art forms, using glass to display a rainbow and illustrate artistic pointillism, creating a record player with household items, creating their own egg tempera paint, and making watershed models. The programs are designed to increase student interest in STEAM concepts and careers through hands-on, and creative activities that incorporate visual arts projects.[79]

Barnes Foundation

The Barnes Foundation in Philadelphia, Pennsylvania offers many programs relating to arts integration and STEAM. One STEAM program in particular, The Art of Looking, is an art program for fifth and sixth grade students where participating classes attend a field trip to the Barnes, along with implementing a pre- and post-visit outreach lesson at their school. The program utilizes this multi-curriculum format for urban students in the Philadelphia region, integrating key curriculum in math and science with exposure to the arts. The fifth grade program focuses on using methods of CER to answer questions about an artwork, paying close attention to materials and what the artwork is made out of. The sixth grade program has more of

[79] "Innovative Summer Camp Carrying STEAM into the Region," Da Vinci Science Center, https://www.davincisciencecenter.org/news/innovative-summer-camp-carrying-steam-into-the-region/.

a mathematic approach, where students are invited to examine the geometry used by artists to create a composition. Both have program goals which emphasize students abilities to analyze a work of art using the appropriate vocabulary; the fifth grade program goals focus more on using claim, evidence, and reasoning when analyzing artwork, while the sixth grade program highlights the mathematic procedure of plotting points on coordinate planes to better understand composition.[80]

The programs briefly reviewed include professional development, tours and workshops, and summer camp programs relating to arts integration or STEAM. The commonalities between the programs offered by these institutions are apparent, and reflective of the research findings. Each program emphasizes the connection between art and science, and consistently reiterates the importance of teaching students skills such as observation and creative problem solving. The participants in the study who were overall confident in their understanding of the definition and relationship between arts integration and STEAM come from the institutions whose programs are mentioned above.

[80] "Art of Looking," Barnes Foundation, https://www.barnesfoundation.org/teachers/.

Chapter 5: Discussion

Over the years the arts and sciences have become disconnected, especially in the field of education. The emphasis on STEM at the expense of the arts could potentially leave students without important life skills such as creativity, collaboration, and critical thinking. STEM initiatives over the years have encouraged many art educators to work to integrate the arts into STEM education through a variety of arts integration efforts. The researcher sought to find clear delineations between arts integration and STEAM efforts in the review of literature; however, current interest in arts integration has not appeared to produce a consensus on the theory or practice of integration, much less a universally held definition of the term. While the Kennedy Center seems to be at the forefront of arts integration research, not all subsequent research was found in congruence with their definition. The purpose of this qualitative study was to gauge how current professionals are defining arts integration and STEAM, noting specifically how participants understand the relationship between these terms and how they are approached in practice. In addition, the researcher also sought to ask museum participants about current programming as to better understand what is currently being practiced and the skills being emphasized through those programs.

The theme of Definition and Relationship that arose in the analysis section was the most important for this study because overall, the purpose of this research is focused on if, how, and why arts integration and STEAM are the same or different. When participants were asked how they would define the term arts integration, it became evident that there was a general understanding based on context that arts integration is an interdisciplinary approach to teaching multiple subjects. This way of defining it is somewhat undeveloped compared to how arts integration has been defined in the literature, however it is an important step on the way to

deeper understanding. It is evident from this analysis that while most participants have a general understanding of what arts integration *could* mean, their interpretation of what it means in relationship to STEAM is varied and inconsistent. How participants defined arts integration compared to how they viewed its relationship to STEAM is the most interesting to note. When participants were asked about this relationship, the codes that emerged validated further that there may be a disconnect among professionals about what these terms actually mean. Some participants seem to be influenced by their discipline, and may have a limited understanding of what arts integration means, making the assumption of believing they are the same. While certain participants believe the terms are one in the same, the most noteworthy responses came from those who firmly stated that the terms are not interchangeable. Those with this firm belief are the same participants who made it clear that they adopted the Kennedy Center's definition of arts integration. The researcher concludes that those who wish to practice arts integration strategies should research and adopt their definition from a reliable source such as the Kennedy Center in order to have a better understanding of arts integration, and how it differs from or is better than a STEAM approach. Since some participants pointed out that STEAM may not integrate the arts as authentically as arts integration, the researcher also concludes that arts integration practices should be at the forefront of formal education since it is evident that these practices involve a well-rounded approach to learning where every discipline is taught equivalently through the arts, as opposed to the ways in which STEAM is taught. The very act of using a term that is already defined by a credited institution not only makes the term definitive, but also validates the programming relating to arts integration. If more professionals would take this initiative it could prove beneficial in creating and maintaining a common framework throughout the educational landscape in both formal and informal educational settings.

Applications to the Field

The idea of arts and science integration has been of special interest to museum educators because they are in the perfect position to provide these resources to K-12 teachers. Museums are often institutions educators can look to in order to enhance what is being taught in the classroom. Museums are being asked to help school curricula by providing arts integration lessons and professional development resources to teachers. Museums also have a strong obligation to support their communities and very often this is filled through educational programming such as field trips, tours, after-school programs and more. Because the relationship between museums and K-12 classrooms is evident, it is vital that there be a common framework of reference for defining arts integration, and the ways to approach it in practice. Although the primary audience for this research is museum educators, this thesis will provide resources for all educators to better understand that a common language and approach is needed in order for museums to provide successful arts integration programming to both K-12 students and educators alike. The results of a more cohesive and well-defined model would be demonstrated through increased student success in areas of the curriculum that are applicable as well as social and emotional learning.

Limitations

Although this research was beneficial in understanding how professionals define and use arts integration and STEAM, there were several limitations to the study. The first limitation was related to the sample size and participants. Overall the sample size was fairly small; gathering more participants, especially those who work in formal K-12 settings, would have been beneficial in gathering conclusions. The lack of K-12 teachers in the sample size makes it difficult for the researcher to come to a consensus on what the formal education realm believes and practices. Both of these limitations have an impact on validity, making the results difficult to

generalize. Another limitation to this study was the instrument used in the interview process. Once the interview process began it became clear that the nature of semi-structured interviews would prove difficult in ensuring that suitable questions for the study were being asked and elaborated on. If the researcher had more time to practice the interview process and revise the instrument, questions and answers could have proven to be more valuable for this qualitative study. There were also limitations in the participants chosen for this study. The researcher initially chose a variety of museum professionals to be included. However, this variety may not have been conducive to the study. If the researcher conducted the interviews with museum professionals who were known to have practiced forms of arts integration or STEAM the results could have been more significant. The fact that some of the participants interviewed did not actually practice arts integration or STEAM alters the researchers overall findings in how professionals are defining these terms. But, having multiple perspectives is still useful to gain a broad understanding.

Recommendations for Further Research

Based on the results of the study, there are a few recommendations for future research. To attain data triangulation, the researcher suggests adding an observation protocol to further the overall analysis of arts integration and STEAM in practice. The researcher also recommends taking the study further by looking at all levels of arts integration; not just visual art, but music, theater, and dance as well, along with examples of arts integrated topics. Because multiple participants throughout the study mentioned design thinking and creative problem solving, further research on the methodology of design thinking in regards to Stanford d.school would prove beneficial. The school offers many online resources for educators interested in learning more about using design thinking to inform their own teaching practice. Also, potentially looking

closer at professional development programs for K-12 educators with a focus on arts integration practices could be advantageous. This particular type of programming is crucial because it is the direct connection between informal museum educators and formal K-12 educators; both must be on the same page in terms of definition and practice otherwise outcomes could be impartial and ineffective.

Conclusion

The data analysis of the results from the interview process reiterates from the literature review of this thesis that there is a lack of consensus among professionals as to what the term arts integration means and how it is viewed in relation to STEAM. From the analysis, the researcher concludes that while there is a general understanding of what arts integration means, the lack of understanding manifests when comparing arts integration to STEAM. While only a few participants noted that they adhere to the Kennedy Center's definition and distinctly reinforce that the terms are not interchangeable, the very fact that they did research and adopted a definition of their own implies that educators who wish to practice arts integration or STEAM should follow suit. Participants who were most confident in defining the term arts integration were those who gathered their definition from the Kennedy Center's research. It is important to note that the participants who mentioned the Kennedy Center definition in the interview process are the same participants who mentioned their institutions distinct programs relating to arts integration and/or STEAM. Since they have clearly delineated that there *is* a difference between arts integration and STEAM, the programs they mentioned are reflective of that difference, and might prove to be more reflective of a consistent definition than those who do not clearly articulate this distinction. Based on this, it is the belief of the researcher that museum educators

should use the Kennedy Center framework as their definition. The Kennedy Center's definition and tools for arts integration should be disseminated to museum educators through professional development and conferences such as the American Alliance of Museums' Education Professional Network (EdCom), which works to define and foster best practices in museum education; and also the Museum Education Roundtable, who publishes the Journal of Museum Education, the only American journal devoted to the theory and practice of museum education.

Until the term arts integration is definitive among professionals, the Kennedy Center's definition proves to be the most developed and beneficial to the field, and a strong placeholder to help further extend this framework. The researcher hopes that by sharing current research and practice on arts integration, this will allow new research agendas, perspectives, and pathways to a definitive and consistent definition across the field. Once a consistent definition among professionals is in place, the educational framework must also be disseminated within an institution so that there will be complete institutional comprehension on how a term is being defined and practiced. Many educators, schools, and art programs benefit from knowing the different ways the arts can be present in schools. Without making a distinction, opportunities can be missed, programs can lack clarity, or the arts can seem like something too unwieldy to incorporate. Conclusively this thesis advocates for an arts integration approach to learning over a STEAM approach because it more clearly aligns to how disciplines are connected, and how students learn inside and outside of the classroom. Having a distinct definition of arts integration can help narrow or focus objectives, as well as help educators select the most appropriate approach based on their curriculum objectives. The findings in this thesis will benefit both formal K-12 educators, as well as K-12 students. If formal educators are in agreement of what

arts integration means and how the term is practiced, then ultimately students will benefit from those consistencies.

Appendix A - Instrument

1. What is your name?

2. What institution do you currently work with?

3. What is your official job title?

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

Appendix B - Quotes

Participant 9 – "the educational approach where the arts are used as integral points of departure in learning. I have also heard this referred to as 'interdisciplinary learning.'"

Participant 12 – "using art as one of the tools and techniques to build skills to hone in on a curriculum that teachers are already doing," using "various aspects of math, science, social studies, and language arts. Visual arts and beyond can be used in conjunction with all of that."

Participant 2 – "ways to pull in art in other lessons and disciplines. You don't hear the term arts integration much out of formal education. This term is broader and more holistically integrated whereas STEAM applies more to singular programs."

Participant 13 – "When I hear arts integration I'm thinking more about art lessons being integrated into core academic classes. For example a math teacher using geometric art in their classroom to teach measurement and vertices and stuff like that. I see it as art being utilized to reach all learners in a core class."

Participant 8 – "In terms of STEM, I would define arts integration as teaching a STEM concept through an art form, or using an art form as the mechanism to introduce the STEM concept."

Participant 11 – "a meaningful integration of arts into the entire curriculum. To be more specific, I think the Kennedy Center's definition makes the most sense and I try to adhere to it."

Participant 1 – "We believe in the Kennedy Center's definition that arts integration is an approach to teaching and learning in which the arts and another subject area are taught together with the intentional purpose to make connections, foster creative and critical thinking and develop awareness of multiple perspectives. At the NCMA, works of art are used as both a catalyst and bridge to help teachers and students see and articulate how ideas and topics connect. Works of art provoke discussion, inspire writing and spur students to create their own art."

Participant 5 – "I guess without knowing exactly how the Philadelphia School District is defining them I would say it's pretty interchangeable here."

Participant 8 – "I don't see a large difference between the two. I'd imagine that arts integration would apply outside the realms of STEM and STEAM (in teaching literacy or social sciences for example)."

Participant 3 – "an umbrella term in which STEAM sits under as a type of arts integration."

Participant 7 – "an umbrella term that encapsulates STEAM and experiential learning."

Participant 1 – “STEAM is a bit more elusive. When we’ve defined STEAM we’ve used the Science, Technology, Engineering, Art and Math definition for the acronym even though there are so many other approaches. We do not consider them the same thing. We feel arts integration can include more subject areas and sometimes STEAM does not actually integrate the arts as authentically as arts integration does.”

Participant 15 – “the arts are sidelined,” and they have “rarely seen that art is a real part of the STEAM conversation.”

Participant 11 – “I’m not even sure I believe they support each other; they are very different.” They go on to explain that their museum has adopted its own definition of STEAM as “the purposeful integration of science, technology, engineering, arts, and mathematics education. STEAM teaching and learning emphasizes process over product and empathy through the use of design thinking, real-world application, student collaboration, and interdisciplinary connections.”

Participant 10 – “STEAM is approached more from a science first point of view whereas arts integration focuses more on the arts as the primary approach.”

Participant 4 – “It’s all STEAM. It’s part of what they do. If you’re doing a good job of teaching STEM then it’s hard to separate out the art and the design. It’s there, it’s one of the fundamental elements of STEM.”

Participant 9 – “Honestly, I don’t care for labels. If you are doing this right then you are naturally weaving many different subject areas into your lesson. As I research and present a lesson, I weave different subject areas into the context of the lesson introduction/demonstration.”

Participant 11 – “we looked at Stanford d.school’s design thinking process to develop our STEAM program. We use this design thinking process in all of our tours, workshops, and professional development seminars. The STEAM program must use the design thinking process and it must include creative problem-solving and collaboration.”

Participant 3 – “sort of an updated scientific method in broad strokes,” where “students are looking at artworks and looking for evidence— which is anything identified with the senses. Students use evidence to make claims. Reasoning is the bridge between evidence and claim. We use this method a lot when doing our STEAM program.”

Participant 15 – “In general the place I like to start is with artful thinking routine (Project Zero’s see, think, wonder). Skills I want them to take away from visits are critical thinking, observation, and discussion. Learning how to talk about what they see and back it up is so important.”

Participant 14 – “Deep learning is achieved through work on projects where the end product is left somewhat open-ended. In doing this type of work, students must use methods of problem solving by testing/prototyping, and revising. When they reflect on their process, they discover a reason to strive for mastery of skills, confidence in their abilities as creative problem solvers, and the importance of perseverance.”

Participant 11 – “two-hour interactive guided tour and hands-on creative problem-solving workshop.”

Participant 12 – “Washington does not have enough funding for education as a whole. Throughout the state education is in debt. Arts were cut. Therefore, a lot of art education is coming from teaching artists or after school programs, or partnering with other art museums.”

Participant 11 – “For arts integration we do professional learning workshops. We believe that the art form (let’s say painting) must hold equal importance to the curriculum (let’s say science).”

Participant 14 – “We hold an active U.S. Department of Education grant to provide professional development for teachers to incorporate science and technology in their standards-based visual arts classes.”

Participant 1 – “For STEAM we offer online mini courses through their website NCMALearn along with many lesson plans for teachers. These programs provide educators with quality professional development, which is lacking in our state. We provide educators with relevant and practical experiences to help them better engage learners. These programs continue to make museums a relevant cultural resource for both teachers and students.”

Participant 1 – “practice scientific inquiry while engaging in works of art in the collection.”

Participant 6 – “we send museum educators into local middle schools and do an hour of STEAM after-school programs.”

Participant 14 – “designed to increase interest in STEAM concepts and STEAM careers through fun, hands-on, and creative activities that incorporate visual arts projects.”

Participant 11 – “We have a STEAM tour and workshop for students. We see about 55,000 students a year. About 8,000 of them will go through the STEAM program. It’s a two hour interactive guided tour and hands-on creative problem-solving workshop.”

Appendix C - Transcripts

Participant 1

1. What is your name?

   Kristin Smith

2. What institution do you currently work with?

   North Carolina Museum of Art

3. What is your official job title

   Program Manager NCMA Connects

4. How would you define the term arts integration? What other terms are frequently used when discussing this topic?

   We believe in the Kennedy Center's definition that arts integration is an approach to teaching and learning in which the arts and another subject area are taught together with the intentional purpose to make connections, foster creative and critical thinking and develop awareness of multiple perspectives. At the NCMA - works of art are used as both a catalyst and bridge to help teachers and students see and articulate how ideas and topics connect. Works of art provoke discussion, inspire writing, and spur students to create their own art.

5. Do you believe there is a difference in definition and/or approach between arts integration and STEAM?

   STEAM is a bit more elusive - when we've defined STEAM we've used the Science, Technology, Engineering, Art and Math definition for the acronym even though there are so many other approaches. We do not consider them the same thing. We feel arts integration can include more subject areas and sometimes STEAM does not actually integrate the arts as authentically as arts integration does. The way we made the strongest connections was through the engineering design process and how the skills you use in that process can be practiced when applied to art making.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   NCMA offers professional development programs that support educators across North Carolina as they connect across disciplines through art. There is also a Fellowship for Collaborative Teaching offered by NCMA to teachers in NC offering yearlong support art integration strategies. We also offer a number of Distance Learning opportunities and Educator Expos. As for STEAM we offer online mini courses through NCMA Learn

along with many lesson plans for teachers. There are also virtual field trips with STEAM related topics. Students practice scientific inquiry while engaging in works of art in the collection. These programs provide educators with quality professional development - which is lacking in our state. These programs provide educators with relevant and practical experiences to help them better engage learners. These programs continue to make museums a relevant cultural resource for both teachers and students.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   A short list would be the 4 C's: Creative thinking, Critical thinking, Collaboration, Communication, and also Visual Literacy

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

   We often collaborate with other organizations as well as often use Teacher Advisory Councils. We've collaborated with: NC State Design Lab, A+ Schools, NC Arts Council, and NCDPI

Participant 2

1. What is your name?

   Amelia Wiggins

2. What institution do you currently work with?

   Delaware Art Museum

3. What is your official job title?

   Manager of Gallery Learning and Interpretation

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   I think arts integration is ways to pull in art in other lessons and disciplines.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   You don't hear the term arts integration much outside of formal education. This term is broader and more holistically integrated, whereas STEAM applies more to singular programs.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   We had a STEAM'd up program from three years ago where 5th and 6th grade students came to the museum for a day and rotated through activities. We developed activities around STEAM and our guides led a STEAM based tour in the museum. It engaged a science population of adults and also engaged middle schoolers but didn't go on from there.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?
   N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 3

1. What is your name?

   Stephanie Stern

2. What institution do you currently work with?

   Barnes Foundation

3. What is your official job title?

   K-12 Programs Manager

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   I think of it, in broad strokes, as teaching other subjects through art. So for example the first time in my own studies I became interested in history was studying art history. Thinking about the ways in which art helps teachers teach other subjects to bring it to life in a different way making it more relevant, appealing and understandable to all types of students with different types of learning modalities. STEM and STEAM are big words associated with arts integration. Outside of the art world people still say STEM. I always use STEAM to make it more well rounded. My sister works in a children's science museum and she says STEM all the time. It’s just part of the workplace culture and what language they use.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   I guess I think about it mostly in terms of subject matter – arts integration is not just about science, and technology but also about history, and languages, I think of arts integration as a broad term, whereas STEAM is focused on science, technology, engineering, art, and math particularly. Arts integration is kind of an umbrella term where STEAM sits under as a type of arts integration.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   So our main STEAM programs are 5-6th grade programs both called Art of Looking, which is a multi touch point, grant funded program. The fifth grade program integrates science and art, so using scientific skills to understand art better. The sixth grade program integrates math with art and they use math to create their artwork. Those are the main programs that we have.

In addition to thinking of scientific skills our programs also focus on materials. So for example looking at the materials artists use to create their artworks in a scientific way. For the fifth grade program we think a lot about 21st century science skills so we identified the CER method, claim, evidence, reasoning - it's sort of an updated scientific method in broad strokes. Students are looking at artworks and looking for evidence- anything you can identify with your senses, sense of sight especially. They use evidence to make claims. Reasoning is the bridge between evidence and claim. We use this method a lot during a tour but we're also looking at materials. We do an exploration of oil, pastel, and watercolor with hands on samples. There are pre and post visit lessons that take place in the school classroom where again students are thinking about gathering evidence using CER method, and also when they're here for the tour there's an hour long workshop where we solve art mysteries using scientific method.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?
   N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 4

1. What is your name?

   Jared Lauterbach

2. What institution do you currently work with?

   Workshop School

3. What is your official job title?

   Math and Science Teacher

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   I think, I mean for me arts integration kind of goes the line of craftsmanship. And so whether you are designing a presentation or building a project or creating architectural drawings, something you're going to build. When I think about art I think about knowing your craft and taking the time to show your craft in your work. Art is involved no matter what. Theme, how you word it, how you design it, it's all art.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   It's all STEAM; it's part of what they do. I think if you're doing a good job of teaching STEM then it's hard to separate out the art and the design. I think when you boil it all down it's there it's one of the fundamental elements of STEM. It's weird to say STEM without art. Even with engineering, there's so much art involved with that. Why does a building look the way it does? It's very present in everything we do.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   An example of a project they're doing right now, they are building an escape room, involving math and logic and puzzle solving, at the same time there's also the other pieces, like figuring out what makes up a great escape room, like scenario and setting of the room and how you present your room to your guests; then they have fundraiser in November. We actually traveled to an escape room for one of our classes, learning different magnet puzzles, chemical reaction puzzles; next week is electricity so they can come up with their own scenario. There are levels of geometry, which are usually isolated subjects in traditional schools but here the students are mixing it all together. They learn how to use geometry when you're building using applicable skills, focusing heavily on

presentations; for instance you may have the best design but if you do a poor job of presenting then no one will get past the crappy presentation you gave. Our seminar classes also focus on integration of subjects. I always try to teach the book math, then at the same time try to teach them how to apply this in the real world.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   It depends on the project. The next project the students will be building an ADA ramp for a local school. So you know as for the ramp, some of it is coming up with architectural design, some is craftsmanship through building, then once it's built or even in design phase, we focus on how it looks. For example are you adding things to make this colorful, what is going to be our standout moment? And try to bring that moment to everything. In the same sense much of what I try to do for the seniors is I try to incorporate projects where I am their guide, not their final grader. The world is their grader. When I think about those things, art is embedded in that process. No specific template because I think that I'm getting the message across that it's about the aesthetic too. Not just the best design.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

Participant 5

1. What is your name?

   Meredith Sellers

2. What institution do you currently work with?

   Mutter Museum of The College of Physicians of Philadelphia

3. What is your official job title?

   Arts and Accessibility Coordinator

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   I guess um arts integration is a way of incorporating, you know, aspects of creative thinking in disciplines that don’t necessarily physically approach it to enrich their programming.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   I guess without knowing exactly how the Philly school district is defining. I would say it’s pretty interchangeable here.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   We have multiple curriculums in afterschool programs that focus on STEM education. Sometimes I’ve done skull drawings that tie into the knowledge they are getting in another part of a lesson. It’s not a STEAM focused program per se but when it's appropriate we involve some sort of arts programing. I run a lot of specimen drawing classes based on our collection. That’s open to the public so I get half folks in the sciences and half who are in the arts related field. The one we offer as a regular lesson for high school students I give a background in basic forensic - what you are looking for when you’re trying to identify a skull, what areas are on a skull and different shapes to identify what happened to the skull. We look at images and draw from images in our collection. Using forensic sciences - go over basic anatomy of the head and go over proportion in drawing the human head and do a demo.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?
   N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 6

1. What is your name?

   Tyler Barton

2. What institution do you currently work with?

   North Museum of Science and Nature

3. What is your official job title?

   Education Manager

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   Arts integration I would think to me means showing all the ways that art intersects with other subjects, fields, careers; whether you're an engineer, designer, artist, there's ways these things overlap constantly and we see that in science field where its interdisciplinary, its chemistry but its also physics; I think art is left out of that so to me it means integrating the art component and how it interacts with these. I don't hear the term used very often but I assume it means adding the A to STEM.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   Talking about this in abstract terms is difficult. I'd like to see a lesson plan that is specifically, philosophically, minded toward arts integration as opposed to one that isn't to help solidify that. Just talking about it is hard to imagine.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   I have not facilitated the programs here at the North Museum yet; I'm doing site visits over the next few weeks visiting with our educators that are doing an after school STEAM program. I just said STEAM, but it's STEM here. It's mostly local students studying to be science teachers and they come to us and get paid a stipend to take materials to take to another school and do a lesson plan. Working on building lesson plan database and I'm finding plenty of lesson plans, One is the art of nature about how the patterns we find in nature are used in art or inspired art. But There are number of programs; STEM sisters is hosted here and is a program here where girls in middle school volunteer to be STEM mentees and pair up with STEM mentors who are women

working in the STEM career fields throughout Lancaster County. They do simple things like meet them and learn what they do and how they got their career. They also go out and do site visits around here and see what people actually do, kind of like a career fair. It's preparing girls for careers in STEM. That's in its 3rd year I believe, big we're having launch party for that on Tuesday. And we have an After School program where we send local educators into local middle school and do hour of STEM after school programs, we call that generally our afterschool program. And we also have STEM career fairs. We get Volunteers from STEM field to go to one school and do a 10 min rotation where students go professional to professional in auditorium and do a quick activity.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   In Minnesota I was more of the educator, I was in front of students and we had school group tours. They explore the museum a bit and come up to our loft where I lead lessons. I wrote the lessons and facilitated them. A lot of it focused on what is the objective, what are 2-3 questions we're going to answer, and then a list of standards we're hitting. Focus on achievable objectives and then the bigger question. That's pretty standard for any lesson plan I feel. Key components for us regardless of activity is opening conversation and discussion that was usually 10 min long that progressed from more basic concepts and then narrowed down to the point of the activity, followed by a hands on activity. We try to do the Opening conversation at the most 15 minutes and then doing activity hands on for 75% of the time. There was also after the activity a time for kids to publish or reflect. Standing at their table and talking to students about what they did, or they could reflect personally with partner on hat they succeeded or failed at. Get together and do a group reflection about challenges and how they overcame them.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

   We've been collaborating a lot with Elizabethtown college directly where students develop lesson plans and activities for the museum, usually things after school instructors can do in 1 hour period that is quick to do quick to clean up, and also on floor activities that would engage visitors.

Participant 7

1. What is your name?

   Lauren Duguid

2. What institution do you currently work with?

   Academy of Natural Sciences

3. What is your official job title?

   Exhibition Designer

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   Arts integration is a tough one. Tough term to define because we could debate the word art and not come to a consensus. The way I see it is that it can be anything from incorporating an opportunity for visitors to have a creative way to observe or to express or to feel by experiencing art brought in from outside. For instance if we have an outside artist collaborator if a visitor is experiencing that I consider that arts integration as well even if they aren't performing the activity. Also art making in order to better understand the other parts of STEAM, if there's a topic that they can get more out of by having a creative exercise, I think that’s an art integrated way to go about it, depending on how its executed. STEAM can involve projects if visitor is actively participated, its not project based if an outside artist is being brought in to interpret. If the visitor is looking at art to understand the natural world better I would consider that arts integration

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   STEAM can sometimes be more project based I think. I'm not an expert in the slightest but I envision arts integration as an umbrella term that encapsulates STEAM and experiential learning.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   The art and science gallery at the Academy is the best example of arts integration that we do or have done at the academy. We will bring it back in a form that's still murky at the moment but we're working on it, it's a very small gallery. I would research artists to be thrown in, I would work with artists to help get their stuff in and interpret it with

specimens or research that we do here at the academy to give it more of a science bend, then do a little exhibit about it. We turn this over about 3 times a year.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?
   N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 8

1. What is your name?

   Jillian Clark

2. What institution do you currently work with?

   The Franklin Institute

3. What is your official job title?

   Professional Development & Outreach Initiatives Coordinator

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   In terms of STEM, I would define arts integration teaching a STEM concept through an art form. Using an art form as the mechanism to introduce the STEM concept.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   I don't see a large difference between the two. I'd imagine that arts integration would apply outside the realms of STEM & STEAM (in teaching literacy, or social sciences, for example).

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   We've offered professional development on STEAM, and were part of a STEAM project called "Making in Afterschool" that was run by the New York Hall of Science.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   Was created by a different institution.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 9

1. What is your name?

   Dan Deslaurier

2. What institution do you currently work with?

   Friends Select School

3. What is your official job title?

   Lower School Visual Arts Teacher

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   I would describe arts integration as the educational approach where "The Arts" are utilized as integral "points of departure" in learning. I have also heard this referred to as "interdisciplinary learning."

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   Honestly, I don't care for labels. If you are doing this right, then you are naturally weaving many different subject areas into your lesson.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   No

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   I don't teach a STEAM program. As I research and present a lesson, I weave different subject areas into the context of the lesson introduction/demonstration.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 10

1. What is your name?

   Tiffany Allen

2. What institution do you currently work with?

   The Academy of Natural Sciences at Drexel University, Philadelphia

3. What is your official job title?

   Manager of Early Childhood Initiatives

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   I would define arts integration as an approach to integrating different forms of art into subject areas that wouldn't normally lend themselves to involving the arts.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   I feel STEAM is approached more from a science 1st point of view and arts integration focuses more on the arts as the primary approach.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   The early childhood programming incorporates more of a STEAM approach due to the developmental needs of young children. Creating a variety of ways to learn about different topics is important and also contributes to the best practice of speaking to the whole child.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   The framework used mainly came from the core curriculum for Pre-K, which involves a wide variety of skills and concepts students need to prepare for Kindergarten. Key components would be providing topics that students are interested in, hands-on activities, flexibility in schedule, and diversity in the subject matter and artist or scientist presented.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

Participant 11

1. What is your name?

   Kate McLeod

2. What institution do you currently work with?

   High Museum of Art

3. What is your official job title?

   Head of School and Teacher Services

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   A meaningful integration of arts into the entire curriculum. To be more specific - I think the Kennedy Center's definition makes the most sense and I try to adhere to it, when teaching about arts integration. I don't use other terms when discussing arts integration. It's very different from STEAM.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   Yes. I'm not even sure I believe they support each other. They are very different. As I mentioned above, I adhere mostly to the Kennedy Center's definition. The High has been doing STEAM work since 2009 and officially since 2013. Someone on my team went on to the be the country's first STEAM Specialist for the Georgia Department of Education. Best of my knowledge, no other state has that position. We worked with them, as well as other organizations, to produce this definition that we use at the High: "STEAM is the purposeful integration of science, technology, engineering, arts, and mathematics education. STEAM teaching and learning emphasizes process over product and empathy through the use of the design thinking, real-world application, student collaboration, and interdisciplinary connections."

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   Yes! We have a STEAM tour and workshop for students. We see about 55,000 students a year. About 8,000 of them will go through the STEAM program. It's a 2-hour interactive guided tour and hands-on creative problem-solving workshop. We also hold an annual STEAM teacher seminar. It's part of a 4-part series with the Zoo Atlanta, Georgia Aquarium, and Atlanta Botanical Gardens. Each institution holds it's own one-day

teacher seminar throughout the school year. We started collaborating with them last year. We also do traveling professional development STEAM programs throughout the state. Last week, we held a one-day program for educators 3 hours away - it was a blast!

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   Yes, we looked at Stanford d.school's design thinking process to develop our STEAM program. We use this design thinking process in all of our tours, workshops, and professional development seminars. The STEAM program must use the design thinking process, which starts with empathy. It must include creative problem solving and collaboration. For arts integration, we do professional learning workshops. We believe that the art form (let's say, painting) must hold equal importance to the curriculum (let's say, science). We're not teaching science through the arts, we're teaching both science and painting. Both things must be equal. And, to note again, we do not use the phrase "STEAM" and "arts integration" interchangeable. They are not interchangeable.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

   Without a doubt. We have an Administrator Advisory Committee that's comprised of over 40 school administrators from all over the state. Within this committee is a STEAM task force. We use their advice to guide us in the development and implementation of our programming. Also, in the development of STEAM, we collaborated exclusively with Georgia Tech's CEISMC department. They helped us develop our STEAM definition and program, starting back in 2009.

Participant 12

1. What is your name?

   Brooke Hutchison

2. What institution do you currently work with?

   Seattle Art Museum

3. What is your official job title?

   Museum Educator

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   I don't have a concise definition I guess because I don't have a short one sentence. Arts integration to me it shows up most when I'm talking to non-art teachers, there's a lot of explaining that I have to do when it comes to that. Or some people for administrators it's convincing what the point is. I usually explain it as using art as one of the tools and techniques to build skills to hone in on a curriculum that teachers are already doing. Various aspects of math, science, social studies, and language arts. Visual arts and beyond can be used conjunction in all of that. It's not to add additional lessons, it's a way to enhance it and provide opportunity for students to learn and be engaged. For a lot of teachers thinking about common core and 21st century standards. It's a way to address those things all in one.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   Arts integration can be found in STEAM, one informs the other. It's like you can find ways to spell by reading, there's ways to approach different types of learning through a larger concept. I think of it as a square in a rectangle. STEAM is arts integration but it's also this separate unique think. STEAM can also be broken down to math and engineering. I think something too we're learning with our STEAM tours focused fully on perspective so it's mostly math integration. Something students are starting to shift is this more social kind of cultural content. They're drifting away from math using this as a way to interpret artists' intent. Students are thinking about why this work of art was created and who it was created for. We'll ask them what's the perspective. It's really broadening it turns into narrative or language arts. It's an access point to make sense of art. Our mission is about connecting art to life. So I think arts integration is any entry

point someone can have to make sense of an artwork. It's more like a broad vision or goal of all of education when there is not an art teacher (or even when there is) to me it is beyond any sort of education movement and I think of STEM vs. STEAM and 21st century skills are way to approach education and have fresh ideas. In addition to all of that there is the bigger theme.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   Washington doesn't have enough funding for education as a hole. Throughout the state education is in debt. Arts were cut. Therefore a lot of art education is coming from teaching artists, after school, or partnering with other art museums. Most people we're working with are non-art teachers so always talking about arts integration.
   We have many examples but will give you one that is more in depth and focused. The title is drawing from nature. It is a program for 2nd graders in one district to visit the Olympic sculpture park, field trip opportunity program for all 2nd graders to have a field trip includes tour and art making activity led by a teaching artist where they explore nature and think about observation. Specifically they think about science and naturalists. With art they think about shape, color, line, and abstraction. Way to pull all of that into one program. In addition to class having field trip and art making and exploring we also provide pre visit lessons for teachers for class time to talk about art and or make art relating to the program, what students are going to be exploring. Post visit lessons too to do another lesson tying into curriculum.

   We've had STEAM tours for 5-6 years now and it's a little unique because the docents took it for themselves. They felt like they were not getting enough middle or high school students and thought if they offered STEAM tours or some sort of arts integration, if they offered STEAM specific they thought they could convince administrators to allow these secondary classrooms to come on a field trip to the museum. The docents formed their own STEAM cohort. They had their own study group that met monthly and developed their own tours. They put a lot of effort into it. It was also this very tight knit group and they were focusing a good deal on STEM concepts and not a whole lot on the art so when the docents took it on they lost sight of what arts integration is. An emphasis on art with this access point via STEAM. And so what we've been trying to do is bridge that gap. The staff reassessed what was happening on these STEAM tours and we've slowly been integrating STEAM tours into broader docent body so now any school touring docent is expected to come and approach 1-2 tours with a STEAM lens. That's been really helpful because it brought it back to the heart of what we are and what we do. While raising awareness with all docents that teachers have this set curriculum there are goals and intention for their visit. That might be STEAM or language arts or social studies. We are a global museum so it could be any agenda. This has been a helpful frame for docents to think okay how am I approaching this work of art. What's my hook? Math? Story? Technique? How STEAM and arts integration have evolved.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Participant 13

1. What is your name?

   Leslie Grace

2. What institution do you currently work with?

   Nebinger Elementary School

3. What is your official job title?

   K-8 Art Teacher

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   When I hear arts integration I'm thinking more about art lessons being integrated into core academic classes. For example a math teacher using a geometric art in their classroom to teach measurements and vertices and stuff like that. I see it as art being utilized to reach all learners in a core class. Beyond that I would think art integration on a broader scale as just being able to offer art classes to students in general.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   STEAM is a perfect example of art integration in that it's not always art focused, which is why there's a push for STEAM so art can be more encompassed in it. Because it's not always art focused it's sometimes just doing math or science, or engineering. So like arts integration is a natural part to STEAM, not as natural to STEM. Some of these ideas go hand in hand with art concepts, it's unavoidable.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   As far as programs, we have taken trips to the Barnes Foundation. Every grade level has a trip there for integrating art into the curriculum. 7th or 8th does more social studies based. The fifth grade is more science based learning to observe scientists and back up those observations with evidence. So that's a fun connection I make in my own room because I saw them modeling that at the Barnes Foundation. When you make an observation about an artwork you have to back it up with evidence.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

N/A

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

   Yeah so I led a workshop with all the teachers in the school where we taped off parts of the school and made murals. Painted in the negative space and peeled away the tape. It inspired a math teacher to do a lesson with students on a smaller scale - on cardboard and students measured vertices and the types of shapes. Did a whole worksheet. I helped more with the artsy part of that and she took on the rest.

Participant 14

1. What is your name?

   Ann Bebout

2. What institution do you currently work with?

   Da Vinci Science Center

3. What is your official job title?

   Professional Development Program Manager

4. How would you define the term “arts integration”? What other terms are frequently used when discussing this topic?

   I like to use the Kennedy Center’s definition “Arts integration is an approach to teaching in which students construct and demonstrate understanding through an art form. Students engage in a creative, iterative, and reflective process that connects multiple subject areas and meets objectives from each.”

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   I believe that both terms refer to the same approach. STEAM specifically integrates the arts (visual arts, dance, music, drama, media arts) in STEM subjects, but arts integration can take place in language arts, world language, and social studies classrooms as well. Maybe this distinction is a little like the debate about whether “crafts" belong in “fine arts.”

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   Yes. Many of our “STEAM TEAM” summer camp, after school, and classroom outreach programs are designed to increase interest in STEM concepts and STEM careers through fun, hands-on, and creative activities that incorporate visual arts projects. With the Carbon-Lehigh Intermediate Unit, we hold an active US Dept. of Education grant to provide professional development for teachers to incorporate technology in their standards-based visual arts classes -- up to 60 art teachers over 4 years, all from low-income schools. Equipment has been purchased for a lending library: 3D printers, computers, programmable microcontrollers, and a laser cutter/engraver.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   No single framework or reference. We are incorporating aspects of Fundamentals of Inquiry from The Exploratorium, Design Thinking from Stanford University's d.school, and mindset/activities/practices described in "Invent to Learn" (Martinez/Stager), "The Art of Tinkering" (Wilkinson/Petrich), MIT Media Lab, Exploratorium Tinkering Studio, National Informal STEM Education network, and many other Maker and STEAM sources. ENGAGEMENT is achieved through student choice, real-world relevance, and playful exploration.

   DEEP LEARNING is achieved through work on projects where the end product is left somewhat open-ended. In doing this type of work, students must solve problems by testing/prototyping, and revising. When they reflect on their process, they discover a reason to strive for mastery of skills, confidence in their abilities as creative problem-solvers, and the importance of perseverance. In addition, content knowledge is transferred to new applications (i.e., math skills in measurement when Making, coding for an interactive artwork, etc.), and students have the opportunity to increase their physical dexterity and spatial reasoning skills.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)

   Yes. Carnegie Science Center has provided expertise on Makerspace development and facilitation. Collaborations with the Baum School of Art in Allentown, PA, are currently being planned. We have arts educators from the Lehigh Valley and Philadelphia on the teaching team for our Professional Development grant project.

Participant 15

1. What is your name?

   Miranda Clark-Binder

2. What institution do you currently work with?

   La Salle University Art Museum

3. What is your official job title?

   Curator of Education and Public Programs

4. How would you define the term "arts integration"? What other terms are frequently used when discussing this topic?

   I'm thinking of it as this way to integrate art into other disciplines. The term that we use in our museum and our literature is we use interdisciplinary all the time. Right now our exhibition is teaching and learning in the art museum. The idea of interdisciplinary is big on our campus. We also use it when making lesson plans for K-12. It's really hard to get art teachers out of school and come on a field trip so we do it all different ways. Principals usually need to know all types of curriculum to make connections.

5. Do you believe there is difference in definition and/or approach between arts integration and STEAM?

   So I guess personally I balk at the idea of STEAM and that the arts need to be justified in that way. I have also personally found every conversation I've had around STEAM, the arts are sidelined. The thing is I rarely have seen that art is a real part of the conversation. I feel like arts integration becomes a way of teaching. It's the idea of incorporating art into other disciplines, whereas STEAM seems like a specific program. My audience is mostly k-12 public school. Quite a few of those schools don't have an art teacher at all. Arts have been taken from their school completely and it is up to the teacher to find art for them. For me that's what arts integration is. They call me and ask how to integrate it into their classroom learning. It becomes individualized for the type of institution I think.

6. Does your institution hold any programs that focus on arts integration and/or STEAM?

   I've been thinking about it and I would say we don't use any STEAM programing. There was talk on a university level to collaborate with school districts to do steam programming that would bring students here to campus. We're a little diff because we're a university art museum. We would expose them to different departments. It never did

materialize. But it was a conversation on campus. I don't have anything packaged for STEAM.

7. Did you use any sort of framework when developing this program? What did it look like at your institution?

   In general, the place I start is with an artful thinking routine (project zero) see, think, wonder. Skills I want them to take away from visits are critical thinking, observation, and discussion. Learning to talk about what they see is so important. What do you see that makes you say that? Those are my starting points. There are other lessons based on elements and principles with an art project. Other ones we do a lot of writing activities. Observation again and writing in the gallery.

8. Have you been in collaborations with content experts in developing a program involving STEAM and/or arts integration? (Clarify if they ask)
   N/A

Appendix D – Kennedy Center Checklist

Arts Integration is

an **APPROACH** to **TEACHING**

in which students construct and

demonstrate

UNDERSTANDING

through an **ART FORM**.

Students engage in a

CREATIVE PROCESS which

CONNECTS an art form

and another subject area

and meets

EVOLVING OBJECTIVES

in both.

ARTS INTEGRATION CHECKLIST		
APPROACH TO TEACHING		
1. Are learning principles of Constructivism (actively built, experiential, evolving, collaborative, problem-solving, and reflective) evident in my lesson?	Yes	No
UNDERSTANDING		
2. Are the students engaged in constructing and demonstrating understanding as opposed to just memorizing and reciting knowledge?	Yes	No
ART FORM		
3. Are the students constructing and demonstrating their understandings through an art form?	Yes	No
CREATIVE PROCESS		
4. Are the students engaged in a process of creating something original as opposed to copying or parroting? 5. Will the students revise their products?	Yes	No
CONNECTS		
6. Does the art form connect to another part of the curriculum or concern/need? 7. Is the connection mutually reinforcing?	Yes	No
EVOLVING OBJECTIVE		
8. Are there objectives in both the art form and another part of the curriculum or a concern/need? 9. Have the objectives evolved since the last time the students engaged with this subject matter?	Yes	No

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