International Journal of Research in Social Sciences
Vol. 14 Issue 01, January 2024,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

STEM To STEAM Education in North America and importance of Art (Eco-art) Education for an IntegrativeLearning and Achievement

Bhavna Karki

Abstract

Art including Eco-art is being recognized as part of a well-rounded education. It has shrunk in the places where it existed because of the expansion of standardized-test-based accountability, which has pressured schools to focus resources on tested subjects. Many new studies, reports and public opinions makes a strong case for arts education and recommends access for all. This means moving from STEM to STEAM curriculum in new schools and supporting art education in existing ones. The learning in the study of the arts is academic, basic, comprehensive and dynamic . It enhances the students' performance in other subjects and has a positive impact on their personalities, self confidence and make them work as a community and become better leaders . It also shows improvements in students' standardized writing scores, reductions in disciplinary infractions, increases in students' compassion for others, increased school engagement, improved attendance, and higher college aspirations. studies show a causal link between arts education and critical thinking outcomes, increased tolerance, increased empathy, and higher motivation to engage with arts and culture.

Keywords:

STEAM Education;
STEM education;
Eco-art; Art education;
Integrative;Learning

Author correspondence:

Bhavna Karki,
Environmental Sciences Professional
and Eco-artist
Email: bhavnakarki2@gmail.com

1. Introduction

Art is one of the essential elements of humanity. Since the beginning of civilization, people have painted, sculpted, told stories, and played music. But in a modern world that so often revolves around the STEM fields of **S**cience, **T**echnology, **E**ngineering, and **M**ath, , does art remain vital? [1]. Societal needs always require responsible people who are aware of what is happening and are constantly contributing in making it better in their best capacity. To make them responsible an education with exposure that can build a positive, constructive and innovative mindset is required. Art provides the same especially Eco Art can be instrumental in bringing social change in present world of climate change, unrest, stress and pressure on natural resources which impact the general well-being of all of us.

Every child starts out with a natural interest in art, but for most it is slowly drained away [2]. Present day education system does not focus enough on teaching children to solve real-world problems and is not interdisciplinary, nor collaborative enough in its approach. Based on the research all over the world, the academic institutions and policy makers have acknowledged that there is a missing part in our education and that crucial missing piece is Art. Now more than ever, it is important to include the arts—the "A" that takes STEM to STEAM and the US has been a pioneer in North America in introducing Art in its education system. Now there is a collective understanding that all students benefit from the arts and is recognized as part of a well-rounded education. But looking at USA, in the 20 years since the No Child Left Behind (NCLB) Act of 2001 which defined "arts" as a "core academic subject," and the six years since the Every Student Succeeds Act (ESSA) of 2015, declared them as part of a "well-rounded education," arts education in American public schools has shrunk dramatically [3].

It has shrunk in the places where it existed because of the expansion of standardized-test-based accountability, which has pressured schools to focus resources on tested subjects [4] . After the recession of 2008, 80% of the nation's schools faced budget cuts. In the meantime, No Child Left Behind and the Common Core State Standards pushed educators to prioritize science and math over other subjects [5]. As of 2015, only 26.2% of African-American students had access to art classes [6].

Many new studies, reports and opinions makes a strong the case for arts education and recommends access for all. This means moving from STEM to STEAM curriculum in new schools and supporting art education in existing ones. The learning in the arts study of the arts is academic, basic, comprehensive and dynamic. It enhances the students' performance in other subjects and has a positive impact on their personalities, self confidence and make them work as a community and become better leaders . It also shows improvements in students' standardized writing scores, reductions in disciplinary infractions, increases in students' compassion for others, increased school engagement, improved attendance, and higher college aspirations [7]. Studies show a causal link between arts education and critical thinking outcomes [8], increased tolerance, increased empathy [9], and higher motivation to engage with arts and culture[10]. There is also simultaneous efforts to integrate Eco-art with art education for increasing the understanding of current environmental issues which impacts all of us. This is with the aim to improve environmental literacy and environmental responsibility in students.

Brief history of STEM to STEAM in the US

The combined curriculum of science, technology, engineering, and mathematics wasn't always known as STEM [11]. According to Stem school use and incorporation of this acronym is young (year 2001), but the U.S. pursuit of education and innovation in science and technology has a rich history and understanding the history of STEM education and innovation can provide a glimpse into what's in store for the future.It is also important to consider the fact that with changing time, the needs of the society has also undergone a huge change. We constantly look if we are missing something that is not able to bring in the desired result. The outlook , needs and well-being is completely different today than it was decades ago and thus it is necessary that we focus on the extra things needed in our education today.

The Early STEMS Years

STEM's development traces back to the Morrill Act of 1862, which created land grant universities to promote agricultural science. The Act later established engineering programs as well. When more land grant institutions emerged, STEM training expanded beyond education and began penetrating the workforce. World War II brought about unprecedented advancements due largely to military, business, and academic collaborations. The 1950s ushered in the Cold War and the space race. In response to Russia's launch of the Sputnik satellite, President Eisenhower inaugurated the National Aeronautics and Space Administration (NASA) in 1958. NASA's establishment didn't necessarily mark the beginning of U.S. interest in science, but it brought more national attention to science education. President Kennedy's promotion of scientific advancement contributed to the 1969 moon landing. The United States continued to see more technological developments throughout the 1970s and 1980s. This period saw the first computers and cell phones. The first artificial heart and first space shuttle landing invigorated the call for enhanced science education [11].

The STEM Acronym and Curriculum

At the turn of the twenty-first century, a consensus emerged that U.S. students' achievements in the STEM disciplines were falling short compared to other industrialized countries. The year 2001 saw a push to address the shortfall. The National Science Foundation (NSF) created the acronym SMET to reflect the standards in science, math, engineering, and technology that educators would follow to teach K-12 students problem-solving, analytical thinking, and science competencies. That same year, Judith Ramaley, NSF Director of Education and Human Resources, changed the acronym to STEM.

In that same year, Arizona's Governor, Janet Napolitano, spearheaded the acquisition of public and private grant funding to support STEM education. Six more states followed suit and secured funding to ensure that every student graduated high school with core science proficiency. The No Child Left Behind (NCLB) Act also passed in 2001, authorizing state-level standardized testing to maintain high academic standards.

Despite state and nationwide efforts to bolster science education, U.S. students were still falling behind. In 2009, President Obama established the Educate to Innovate Initiative. The Initiative included preparing 100,000 STEM teachers by 2021 and called for increasing federal funding toward STEM education.

Two notable developments occurred in 2015. One was the STEM Education Act of 2015, which added computer science to the STEM curriculum and provided more teacher training. Congress also passed Every Student Succeeds Act (ESSA) in year 2015. This legislation replaced NCLB, modifying standardized test usage and expanding the federal government's role in K-12 public education. The STEM curriculum and

concept continued to flourish and change. Schools increasingly provide application and problem-solving experiences to create more awareness of STEM among students of diverse backgrounds [11].

Introduction of STEAM- The academic community has begun to show interest in encouraging and closely articulating the humanities with the sciences and technologies, as one of the keys to human development [12]. The key innovator credited with updating STEM to STEAM by adding the Arts is Georgette Yakman, an engineering and technology teacher who was the founding researcher of the STEAM educational framework in 2006.The Rhode Island School of Design (RISD), one of the early champions of adding the arts to the original STEM framework to create STEAM, said that doing so emphasizes the vitally important "symbiosis between the arts and sciences." According to RISD, "The goal is to foster the true innovation that comes with combining the mind of a scientist or technologist with that of an artist or designer."[13]

However, the change was not about just "adding another thing" to STEM. Yakman explains that: "STEAM is about more than converging the fine arts and design thinking into STEM fields. The liberal arts are, the 'who & why,' the reasoning, to the 'what & how' of STEM."[13] She proposed the term STEAM, written as ST∑@M, from an integrated curriculum perspective [14][15]. Yakman (2008) defined ST∑@M as "a developing educational model of how the traditional academic subjects (silos) of science, technology, engineering, arts and mathematics can be structured into a framework by which to plan integrative curricula" (p. 1). Since then, there has been growing international interest in STEAM pedagogy amongst educational researchers, practitioners, and leaders [16].

By 2012, the United States National Research Council proposed STEAM (Science, Technology, Engineering, Arts and Mathematics) as a new method of teaching K-12 science classes. Since then teachers around the world have used this way of teaching to great success. In a 2016 study, researchers investigated the impact of STEAM classes on the learning of students aged 8 to 11 in high-poverty elementary schools in an disadvantaged, urban district. They discovered that students who received just nine hours of STEAM instruction improved dramatically in their science achievement [17]. By 2019, nearly 3,000 teachers in the United States and worldwide have been trained in STEAM education [18].

Overall, the present day education system need to focus enough on teaching children to solve real-world problems and is not interdisciplinary, nor collaborative enough in its approach. Based on the research all over the world, the Academic institutions and policy makers have acknowledged that now more than ever, it is important to include the arts—the "A" that takes STEM to STEAM and advocate for more integrative curricula in school education which should incorporate subject like Eco-art.

Eco-art is an emerging field of environmental education art education and studies conducted at the elementary and high school level in Canada and the US were presented to show that the implementation of Eco-art education can help support students' ecological literacy and develop awareness in environmental, social, cultural, political and economic issues through art making. The demand for the interconnection between art and science by educators, critics and curators has been the grounds for the development of several theoretical perspectives on Eco-art education in North America. Eco-art can raise students' awareness of interdisciplinary issues and understand the interdependence and inter-relation of everything through the concept of ecology. Most of the literature in the field is focused on theoretical and pedagogical perspectives, and further research needs to be done in understanding the perceptions of educators in implementing Eco-art education curricula and pedagogy at elementary and secondary school levels [19][20].

This paper attempts to understand -Why is it so important to keep the art education especially Eco-art strong in our schools? and How does study of the arts (Eco-art) contribute to student achievement and success? and the way forward.

2. Research Method

The present report is primarily based study, involving compilation and analyses of information and data from official documents, research papers/reports, media reports and articles. There are two questions are explored:

a) Why is it so important to keep the art education especially Eco-art strong in our schools?

b) How does study of the arts (Eco-art) contribute to student achievement and success?

This followed by a conclusion and a suggestive way forward.

3. Results and Analysis

This section focuses on understanding out primary questions with the help of existing research papers and reports with respect to the US.

3.1 Why is it so important to keep the art education especially Eco-art strong in our schools?

Arts education definitely helps students think outside the box and explore topics in an unfamiliar way. This matters for three primary reasons: the variety and viability of innovation, the increased inclusion of innovators and the creation of pathways from passion. The integration of Eco-art education enables empathetic understanding and of ecological issues.

The **ABCD** of the impact of art in overall enhancement of a student can be summarized in four categories: **A-A**cademic, **B-B**asic**, C-C**omprehensive **, D-D**ynamic

i). **A**cademic -

i.a) Improve overall academic performance with improved skills like Reading and Language Skills and Mathematics Skills - Students who study arts show improved language, reading, and math skills, as well as a greater ability for higher-order ability for higher-order thinking skills such as analysis and problem-solving [21].

i.b) Motor skills- Motor skills in the classroom give students the ability and skill to work independently. When engaging in expressive and creative arts, children develop better hand-eye coordination and fine motor skills. What physical exercise does for large motor skills, art activities can do for the more intricate and fine motor skills necessary in all aspects of life, from handwriting to wiring robotics [22]. Art classes helps in strengthening the small muscles in the child's fingers, hands and wrists, making it easier to learn to write especially in young kids.

i.c) Communication

Art can be a powerful tool for communication. By creating art, children can express themselves in ways that may be difficult to articulate verbally. This can help them develop their communication skills, including the ability to express their emotions effectively. Additionally, art can provide a nonverbal way for children to communicate with others, which can be especially helpful for children who struggle with verbal communication [23].

ii). **B**asic-

ii.a) Social Skills like Team work- Art is mostly collaborative work and students are more open to learn , collaborate and expand their outreach by being more thoughtful . Since the STEAM curriculum has a holistic collaborative approach, it also helps improve students' emotional intelligence and social skills. They learn how to work with others and be expressive, and to become more socially adaptable. They will be able to deal with various types of personality and cultural background. Empathy, leadership, and friendship are also developed in this process [24].

ii.b) Critical thinking and problem solving

Education experts who've examined why there's a link between art experience and improved critical thinking cite a number of factors at play [25]. In particular, art education teaches students to observe the world more closely. Good art is often complex, layered with multiple elements and meanings. It takes time to find, examine, and consider the numerous details that constitute most works of art. This process of observation and study helps teach students to more closely observe and analyze the world around them—skills that make up the bedrock of critical thinking[26]. Eco-art for example induces empathy to the environmental issues and helps them to be environmentally more sound and responsible.

iii). **C**omprehensive

iii.a) Positive learning School Environment

The arts help create the kind of learning environment conducive to teacher and student success by fostering teacher innovation, a positive professional culture, community engagement, increased student attendance, effective instructional practice and school identity [27].

iv). **D**ynamic

iv.a) Decision making- Art education makes students good decision makers because art is individual choice and it doesn't have set rules. Students get time to go through the process and try different things before they are satisfied with their art work.This will help the child develop the courage to make decisions without developing the fear of failure.

iv.b) Leadership skills- Good decision makers are often the good leaders so it is more likely for the child to grow up as a guide or leader and not just a follower. STEAM activities also teach kids how to work collaboratively and communicate effectively. Many STEAM projects require kids to work in teams or

groups, where they must share ideas, delegate tasks, and listen to others' perspectives. These are all essential skills for leaders to have. [28].

iv.c) Curiosity Stimulation: STEAM education can definitely help students learn the skills like curiosity that they need to succeed in their life. When students are encouraged to be curious about various topics in education, they ask more profound questions throughout their lives. They are also learning to be independent learners, unafraid to challenge authority and seek new information. Curiosity can contribute to a lifetime of learning and discovery, which will enrich their quality of life [29].

3.2 How does study of the arts (Eco-art) contribute to student achievement and success?

Multiple research studies support the notion that students who engage in the study of the arts perform better in math, reading, and writing [30]. Public opinion is also very strongly in favor of arts. A nationwide public opinion survey on the arts and arts education conducted by Americans for the Arts in 2015 shows that:

91 percent of Americans believe that the arts are part of a well-rounded K-12 education. Majority believe that arts education is important at all grade levels The value of arts education is not limited to just the in-school experience. 83 percent also agree to the importance of the arts to students outside of the classroom and throughout the community[31].

Research has shown that training in the arts also helps students hone their ability to pay closer attention and practice self-control. In 2009, researchers at the Dana Foundation, which funds neuroscience research and programming, posited based on multiple studies that training in the arts stimulates and strengthens the brain's attention system[32]. A first ever, large-scale, randomized controlled trial study released by the Houston Education Research Consortium in 2019, focused on arts education in 42 elementary and middle schools in the Houston area with over 10,000 students taking part.They concluded that arts education has a benefit to students in terms of academic, emotional and social outcomes. One of the findings was that arts had a positive impact on writing test scores[33].

Study has shown a correlation between students who take any kind of art course in high school and higher SAT scores (both verbal and math) than students who take no art course at all. Moreover, those who take four years of arts courses have higher scores than those who take less than four years' worth. This means, students who study the arts are consistently higher academic achievers than students who do not study the arts[34].

Another study makes a great many links between learning in the arts and student achievement. Different art discipline are connected to significant outcomes. For example, in the visual arts, there are findings about how drawing supports writing skills and how visualization training supports interpretation of text. In music, researchers found strong connections to spatial reasoning and math, and between instrument instruction and SAT scores. Dance instruction was connected to fluency in creative thinking and to reading skills. Drama in the form of dramatic enactment was connected to story comprehension, character understanding, and writing proficiency, and is shown to be a better way for students to process a story than teacher-led discussion. Multi-arts programs, as you might expect, had multiple connections: to reading, verbal, and math skills, and to creative thinking[35][36].

Eco-art improves the environmental perception and understanding of environmental issues. It can also contribute in developing students' empathy for the environment. Eco-art education integrates knowledge, skills, values and pedagogy from the visual arts, art education and environmental education as a means of developing awareness of and engagement with environmental concepts and issues such as place, interdependence, systems-thinking, biodiversity, and conservation [37]. Eco-art education integrates knowledge, skills, values and pedagogy from the visual arts, art education and environmental education as a means of developing awareness of and engagement with environmental concepts an issues such as place, interdependence, systems-thinking, biodiversity, and conservation [38].

4. Conclusion

The addition of the 'A' (The Arts) to the original STEM discipline to create STEAM is important in part because practices such as modeling, developing explanations and engaging in critique and evaluation (argumentation), have too often been under emphasized in the context of math and science education [39]. STEAM brings together five critical disciplines to create an inclusive learning environment that encourages all students to participate, collaborate and problem solve. This holistic approach encourages students to exercise both the left and right sides of their brains simultaneously, as they would need to do in a 21st century working environment [40]. Despite its short history, STEAM's rapid adoption and tales of success have already spoken volumes. STEAM education is a reliable path to new ways of problem-solving, innovating, and purposefully linking fields of learning [41].

All these findings provide strong evidence that arts educational experiences can produce significant positive impacts on academic and social development [42]. Integration of subject like Eco-art into the art

education opens up possibilities for students to connect in a more emotional way to the environment[42][43]. Eco-art provides a concrete way for students to connect with the environment, which helps to develop their relationship with the environment [44]. Interest and connection with environment or nature enables students to engage more with its learning and conservation.

The Way forward- The case for the arts may not be fully made until a new comprehensive theory of learning is developed that acknowledges the many ways of thinking, knowing, and representing that are available through the arts. There is a need to investigate the structural and neurological relationships between learning in the arts disciplines and other learning and to explore how to deliver high quality arts education in real educational settings that maximize those relationships. The arts are recognized as a core academic subject under the federal Elementary and Secondary Education Act, and, as of 2020, all 50 states plus the District of Columbia have adopted standards for learning in the arts[45].The last comprehensive national arts education report by the U.S. Department of Education is over 10 years old. So more assessment needs to be done.Policymakers need to be more mindful and considerate of the multifaceted educational benefits when assessing the opportunity costs that come with decisions pertaining to the provision of the arts in schools.

There is need to give more attention to how the arts foster transfer of knowledge so that , capitalize on that capacity further. There is no argument that arts programs must be based on their merit. All that is required today is a well-rounded education and study of the arts is an important component of it.

The best education for children is to ensure that they will grow up to lead productive and happy lives. The arts have been around ever since the civilization started and all societies around the world have always included the arts in every child's education. School authorities, students and parents should treat the arts as seriously as we treat any other subject.Studying the arts should not have to be justified in terms of anything else. Treat art as important as the sciences: they are time-honored ways of learning, knowing, and expressing [46]. Students need to be thinkers, possess people skills, be problem solvers, demonstrate creativity and work as a team member. The arts provide all of these [47].

More research is needed in support of the claim the arts improves academic achievement improves. Not to justify the arts on non-arts outcomes, research is required to know how the arts can serve as vehicles for transfer . It is time to look seriously at the possibility that the arts are associated with academic achievement and how the arts can provide engaging and motivational entry points into academic study for the many students who not thrive in the our present schools structures and culture. Eco-arts education provides students, educators, and community members with tools to tackle multifaceted scientific issues in the ecosystem and create environmental awareness, create positive environmental behavioral changes, spread environmental literacy and increase sustainability initiatives [48]. Eco-art education, by its very nature, encompasses many of the 21st century competencies that educators need to teach students to prepare them to succeed in a rapidly changing world [49]. There is a need to integrate art and and environment or ecology in our schools. An Eco-art curriculum will incorporate ecology in the arts and be a resource for educators and other stakeholders. The focus of the curriculum should be to examine and utilize Eco-art to raise awareness of the environmental issues, better the ecological literacy so that students can work to protect the environment. Thus, Eco-art needs to be developed and integrated in art education. Art education needs to be added to the basic building blocks of learning and in the school curricula in an integrative way.

References

[1] Walden University. (2019a, February 15). Does Art Boost a Student's Critical Thinking? | Walden University. Waldenu.edu; Walden University. https://www.waldenu.edu/online-masters-programs/ms-in-education/resource/does-art-boost-a-students-critical-thinking

[2] Gregory, D. (2018, August 24). Let's get rid of art education in schools - kappanonline.org. Kappanonline.org. https://kappanonline.org/gregory-lets-get-rid-art-education-schools/

[3] Franklin, A. (2021, September 14). New report makes the case for arts education: Recommends access for all. American Academy of Arts & Sciences. https://www.amacad.org/news/arts-education-report

[4] Kisida , B., & Bowen, D. H. (2019, February 12). New evidence of the benefits of arts education by the Brookings Institution. Arts Action Fund. https://www.artsactionfund.org/new-evidence-benefits-arts-education-brookings-institution

[5] EdSource Staff. (2014, April 8). Effort to revive arts programs in schools gains momentum. EdSource.

[6] Metla, V. (2015, May 2014). School art programs: Should they be saved? Law Street.

[7] D. H. Bowen and B. Kisida, The Arts Advantage: Impacts of Arts Education on Boston Students (Boston: EdVestors, 2021).

[8] Bowen, Greene, and Kisida, "Learning to Think Critically."

[9] Greene, Kisida, and Bowen, "The Educational Value of Field Trips."

[10] Brian Kisida, Jay P. Greene, and Daniel H. Bowen, "Creating Cultural Consumers: The Dynamics of Cultural Capital Acquisition," Sociology of Education 87 (4) (October 2014): 281–295.

[11] Rich history of STEM education in the united states. (n.d.). Www.stemschool.com. https://www.stemschool.com/articles/rich]-history-of-stem-education-in-the-united-states.
[12] Katz-Buonincontro, J. (2018). Gathering STE(A)M: Policy, curricular, and programmatic developments in arts-based science, technology, engineering, and mathematics education Introduction to the special issue of Arts Education Policy Review: STEAM Focus. Arts Education Policy Review, 119(2), 73–76. https://doi.org/https://doi.org/10.1080/10632913.2017.1407979 [Taylor & Francis Online], [Google Scholar]
[13] Lathan, J. (2019, May 15). The Movement Towards a STEAM Education in Schools. University of San Diego. https://onlinedegrees.sandiego.edu/steam-education-in-schools/
[14] Yakman, G. (2008, February). STEAM education: An overview of creating a model of integrative education. Pupils' attitudes towards technology (PATT-19) conference: Research on technology, innovation, Design & Engineering Teaching, Salt Lake City, Utah, USA.
[15] Yakman, G., & Lee, H. (2012). Exploring the exemplary STEAM education in the U.S. as a practical educational framework for Korea. Journal of the Korean Association for Science Education, 32(6), 1072–1086.
[16] Leavy, A., Dick, L. K., Meletiou-Mavrotheris, M., Efi Paparistodemou, & Stylianou, E. (2023). The prevalence and use of emerging technologies in STEAM education: A systematic review of the literature. Journal of Computer Assisted Learning. https://doi.org/10.1111/jcal.12806.
[17] s.r.o, V. A. (n.d.). H2 grand prix STEAM education - where did it come from? Www.h2grandprix.com. https://www.h2grandprix.com/steam-education-where-did-it-come-from/t1446.
[18] What is STEAM education: The future of 21st century education | kai XR. (n.d.). Www.kaixr.com. https://www.kaixr.com/post/steam-education
[19] Inwood 2005, 2010).Inwood, H. (2005). Investigating Educators' Attitudes Toward Eco-Art Education. Canadian Review of Art Education: Research & Issues, 32(1).
[20] Inwood, H. (2010). Shades of Green: Growing Environmentalism through Art Education. Art Education, 63(6), 33-38.
[21] 7 Reasons why arts education is important for students. (2023, January 6). Varthana. https://varthana.com/school/arts-education-in-the-classroom-7-reasons-why-its-important/.
[22] Why the Arts Are an Essential Part of a STEM/STEAM Curriculum. (2023). L.A. Parent. https://www.laparent.com/sponsored-content/why-the-arts-are-an-essential-part-of-a-stem-steam-curriculum/.
[23] Melody. (2023, March 16). how arts can improve children's social skills — Children Art & Drawing classes. Happy Picasso. https://www.happypicasso.com/blog/2023/3/16/how-arts-can-improve-childrens-social-skills#:~:text=Whether%20it.
[24] 8 benefits of STEAM education. (n.d.). Www.arduino.cc. https://www.arduino.cc/education/8-benefits-of-steam-education/
[25] Greene, J. P., Kisida, B., Bogulski, C. A., Kraybill, A., Hitt, C., & Bowen, D. H. (2014, December 3). Arts Education Matters: We Know, We Measured It (Opinion). Education Week. https://www.edweek.org/teaching-learning/opinion-arts-education-matters-we-know-we-measured-it/2014/12)
[26] Walden University. (2019b, February 15). Does Art Boost a Student's Critical Thinking? | Walden University. Waldenu.edu; Walden University. https://www.waldenu.edu/online-masters-programs/ms-in-education/resource/does-art-boost-a-students-critical-thinking.
[27] Ruppert, S. S. (2006). Critical Evidence how the arts benefit student achievement. National Assembly of State Arts Agencies.Critical Evidence.
[28] Elzanne, A. (2023, January 8). How STEAM activities build your child's leadership skills. TekkieUni - Coding for Kids. https://tekkieuni.com/blog/build-leadership-skills-at-home/#:~:text=Many %20STEAM%20 projects %20require%20kids.
[29] Allard, A. (2023, October 26). STEM vs STEAM education: What's the difference? Thanksgiving Point. https://thanksgivingpoint.org/blog-stem-vs-steam-education/.
[30] Chen, G. (2023, February 13). How the Arts benefit your children academically and behaviorally - publicschoolreview.com. Public School Review. https://www.publicschoolreview.com/blog/how-the-arts-benefit-your-children-academically-and-behaviorally#:~:text=Multiple%20research %20studies%20 support% 20the.
[31] Cohen, R. (2016, March 5). The American Public Says YES to Arts Education! ARTS Blog. https://blog.americansforthearts.org/2019/05/15/the-american-public-says-yes-to-arts-education
[32] Warner, A. (2022, August 30). The benefits of arts education for K-12 students. Https://Www.usnews.com. https://www.usnews.com/education/k12/articles/the-benefits-of-arts-education-for-k-12-students
[33] Hamilton, E. (2019, August 16). How Arts Education Can Improve Student Writing. Counsel & Heal. https://www.counselheal.com/articles/40220/20190816/how-arts-education-can-improve-student-writing.htm
[34] Vaughn, K., & Winner, E. (2000). SAT Scores of Students Who Study the Arts: What We Can and Cannot Conclude about the Association. Journal of Aesthetic Education, 34(3/4), 77. https://doi.org/10.2307/3333638
[35] Rabkin, N. (2022). Connections between Education in the Arts and Student Achievement. GIA Reader, Vol 13(Fall 2002). https://www.giarts.org/connections-between-education-arts-and-student-achievement].
[36] Deasy, R. J. (2002). Critical Links: Learning in the Arts and Student Academic and Social Development. Https://Www.govinfo.gov/; Arts Education Partnership. https://www.govinfo.gov/content/pkg/ERIC-ED466413/pdf/ERIC-ED466413.pdf
[37] Sunassee, A., Bokhoree, C., & Patrizio, A. (2021). Students' Empathy for the Environment through Eco-Art Place-Based Education: A Review. Ecologies, 2(2), 214–247. https://doi.org/10.3390/ecologies2020013
[38] Inwood, H. (2007). Artistic Approaches to Ecological Literacy: Developing Eco-art Education in Elementary Classrooms. Marilyn Zurmuehlen Working Papers in Art Education, 2007(1). https://doi.org/10.17077/2326-7070.1399

[39] Lathan, J. (2015, September 4). Why STEAM is so Important to 21st Century Education. University of San Diego Online Degrees. https://onlinedegrees.sandiego.edu/steam-education-in-schools/#:~:text= Before% 20 there%20was%20STEAM%2C%20there
[40] The History and Importance of STEAM Education. (2020, August 3). STE(A)M Truck. https://www. steamtruck.org/blog/steam-education-history-importance
[41] Greene, D. (2023, April 17). What is STEAM Education: The Future of 21st Century Education | Kai XR. Www.kaixr.com. https://www.kaixr.com/post/steam-education
[42] Holmes, S. A. (2002). Creative by nature: Integrating the arts into environmental science education. Green Teacher, 69, 23-28.
[43] Anderson, T., & Guyas, A. S. (2012). Earth education, interbeing, and deep ecology. Studies in Art Education, 53 (3), 223-245. Bowen, D. H., & Kisida, B. (2019). Investigating Causal Effects of Arts Education Experiences . In https://rice.app.box.com. Rice University's Kinder Institute for Urban Research. Investigating Causal Effects of Arts Education Experiences Final_0.pdf
[44] Song, Y. I. K. (2008). Exploring Connections between Environmental Education and Ecological Public Art. Childhood Education: Journal of the Association for Childhood Education International, 85(1), 13-19.
[45] ArtScan at a Glance. (2018, March). Https://Www.ecs.org/; Arts Education Partnership . https://www.ecs.org/wp-content/uploads/2018_ArtScan-at-a-Glance.pdf
[46] Hetland, L., & Winner, E. (2001). The Arts and Academic Achievement: What the Evidence Shows. Arts Education Policy Review, 102(5), 3–6. https://doi.org/10.1080/10632910109600008
[47] Education Matters Article: The Importance of Arts Education in Schools. (n.d.). In https://www.beautifulplainssd.ca. Retrieved December 7, 2023, from https://www. beautiful plainssd . ca / uploads/9/6/3/0/9630957/2017-01-importance_of_arts.pdf
[48] Sams, J., & Sams, D. (2017). Arts Education as a Vehicle for Social Change: An Empirical Study of Eco Arts in the K-12 Classroom. Australian Journal of Environmental Education, 33(2), 61–80. https://doi.org/10.1017/aee.2017.15
[49] Walters, J. (1993). EcoArt: Envisioning and Inspiring Change. https://dspace.library. uvic.ca/ bitstream / handle /1828/5277/Walters_Jillian_Masters_Copyright2014.pdf?sequence=1&isAllowed=y