

Integrating the Arts with STEM Cohort



Cohort Question:

How do the arts equitably engage and teach diverse youth in STEM?

Cohort Members:

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- ▶ Tim Needles, Five Towns College and Smithtown School District
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Key Findings: Represented by a series of questions we asked ourselves and the group

- Why does it matter that we **center the arts** in work focused on STEAM and equity?
 - The arts bring humanism and subjectivity to inquiry. Art-making is a fundamental part of human development.
 - Arts-based curricula may improve STEM learning outcomes for all
 - The arts offer common spaces for engaging with STEM through valuing divergent approaches and outcomes from across communities, notably underrepresented and historically marginalized communities
 - The arts allow us to embrace a “tinkering mindset”, a different way of thinking in environments that are “doing science”, specifically through design, problem solving, and an emphasis on creativity
 - Research on learning in and through the arts describes development of the following skills and habits of mind: Creativity, imagination, innovation, risk-taking, conflict resolution, peace building, collaboration, agency, comfort with communication, reflective practice, adjacent possibilities, perspective-taking
- How do we **define arts integration** specifically as it applies to integration with STEM?
 - As processes, routines, structures for learning. These processes have inherent qualities and capacities that are broadly applicable across learning environments
 - As an integrated discipline (see definitions of transdisciplinarity)
 - As a perspective shift to see problems differently
 - As STEAM (that is another discipline alongside science, technology, engineering, and math)
 - Through shared epistemological understanding of what it is to “do” science and “do” arts
- How do we **define equity** in the context of STEAM/arts integration experiences?

Priorities for Future Research



- ▶ When focusing on the arts in the context of ISL, several tensions emerge that ought to be explored in future research and practice:
 - ▶ There are multiple ways the arts can fit into the landscape of ISL and equity practice – we can integrate the arts, we can engage in arts integration, or we can think transdisciplinarily and forgo distinctions between disciplines. What is the most impactful for young people?
 - ▶ How do we make the conversation between artists and scientists bidirectional? In research and in practice, artists see the value of collaboration and integration, but scientists often need to be convinced. STEM is still seen as the “more valuable” part of the collaboration.
 - ▶ How do we avoid the “art project” version of integration (i.e. take your science project and decorate it).
- ▶ How do we engage with educators in professional learning so that they feel knowledgeable in engaging meaningfully in and with the arts?

Case Study 1: Digital Youth Network

Digital Youth Network (DYN) is a research lab focused on designing more equitable systems for youth. They are a team of researchers, product designers, technologists and practitioners that have worked at every level of the out-of-school time space since 2005. They have led citywide OST networks, redesigned how public libraries can engage youth, delivered STEAM programming for thousands and developed a purpose-built infrastructure specifically for OST.

<https://digitalyouthnetwork.org>

Key Outcomes: Of particular interest are the STEAMBassadors community mentorship initiative that trains mentors from local colleges and universities to lead curated STEAM curricula and the STEAMVILLE online platform for youth and mentors to engage in STEAM learning.

Welcome to STEAMville!

STEAMville where youth discover, develop and showcase their STEAM interests and identities in community with classmates, family, teammates, and friends nurtured by a village of parents, educators, coaches, and mentors.

Explore Now



Case Study 2: Cool Science



Art + Science = Learning for All. The Cool Science team brings a new approach to the challenge of improving public understanding of climate science.
<https://coolscience.net>

Key Outcomes:

Cool Science aims to engage students, teachers, parents, and the general public from Massachusetts, Kansas, and Missouri with the science of extreme weather through a statewide K-12 student art competition designed to foster learning about climate science. Students (and their teachers) are encouraged to develop a visual work of art that addresses one of three questions about extreme weather. Winning entries have their work put on public display on local regional bus transit authorities.

Over the last seven years, Cool Science piloted a small-scale program in Massachusetts. The program won awards and was honored by the White House as an exemplary project to improve climate literacy across a community.

Because of its proven popularity and effective engagement with all ages, Cool Science added partners in the nation's heartland in Kansas and Missouri. Now, buses with children's winning artwork will ride in four regions (Merrimack Valley, Worcester, Kansas City, and Topeka). During each year of this 3-year program, roughly hundreds of youth, hundreds of adult mentors, and tens-of-thousands of bus riders will have the chance to learn about the science of extreme weather.



Congrats to Kaylin, a 10th grader from Tyngsborough, the Massachusetts David Lustick Winner!



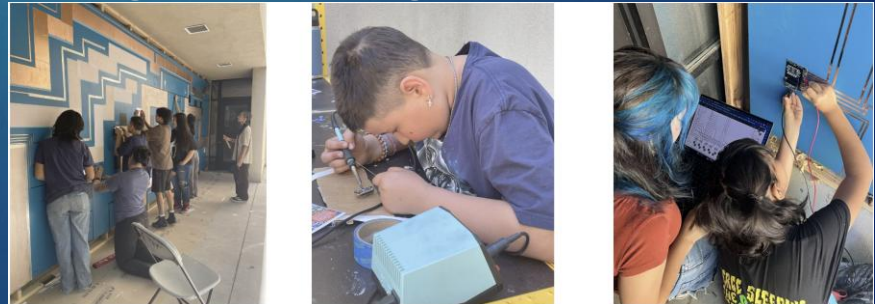
Congrats to Dhairya, a fifth grader from Kansas City, the Kansas David Lustick Winner!

Case Study 3: Hand and Machine

Hand and Machine is a research group in the Department of Computer Science at the University of New Mexico. We explore relationships between technology, materials, and culture. We invent new technologies that are inspired by the rich cultural and material diversity of the physical world. We believe that by making technology more accessible and using computers in novel, unexpected contexts, we can change and broaden the culture of technology. We aim to create new artifacts and tools that have an impact both within and outside of academia—shifting and expanding the technical and cultural landscape of technology. <https://handandmachine.org>

Representative Project:

PAHTIA is an interactive site-specific mural that creates shifting soundscapes in response to touch. This work was created by asking the question: How can we create spaces for community and individual healing? How does the activation of space contribute to healing? This mural was created in collaboration with a group of diverse Albuquerque middle and high school students. Through the project, students were introduced to electronics, programming, and interaction design. Students were deeply involved in every aspect of the project including conceptual design, visual design, and interaction design, as well as construction.



Some Key Resources

Arts Education Partnership (n.d.). <https://www.aep-arts.org/steam-resource-guide/>

Gaskins, N. (2021) *Techno-Vernacular Creativity and Innovation: Culturally Relevant Making Inside and Outside of the Classroom*. The MIT Press.

Halverson, E. R. Saplan, K., Mejias, S., & Martin C. K. (2023). What we learn about learning from out-of-school time youth arts organizations. *Review of Research in Education*, 47(1), 360-404.

Halverson E. R. (2021). *How the Arts Can Save Education*. Teachers College Record.

Hetland, L., & Winner, E. (2004). Cognitive transfer from arts education to nonarts outcomes: Research evidence and policy. In E. W. Eisner & M. D. Day (Eds.), *Handbook of research and policy in art education* (pp. 135-161). Lawrence Erlbaum.

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Ludwig, M., Boyle, A., & Lindsay, J. (2017). Review of Evidence: Arts Integration Research through the Lens of the Every Student Succeeds Act. *American Institutes for Research Special Report*. <https://www.air.org/resource/report/review-evidence-arts-integration-research-through-lens-every-student-succeeds-act>

Mejias, S. et al. (2021). The trouble with STEAM and why we use it anyway. *Science Education*, 105, 209-231 <http://doi.org/10.1002/sce21605>

Needles, T. (2020). [STEAM Power: Infusing Art Into Your STEM Curriculum](#). ISTE.

Song, M., Ludwig M., and Marklein M.B., (2016). Arts Integration: A Promising Approach to Improving Early Learning, American Institutes for Research <https://www.air.org/resource/report/arts-integration-promising-approach-improving-early-learning>

Stewart, A. J., Mueller, M. P., & Tippins, D. J. (2019). *Converting STEM into STEAM programs: Methods and examples from and for education*. Springer.

Wan, Y., Ludwig, M., Boyle, A., & Lindsay, J. (2020). The Role of Arts Integration and Education in Improving Student Outcomes. *State Education Standard*, 20(1), 36-41 <https://eric.ed.gov/?id=EJ1241600>

Wolf Trap Institute for Early Learning Through the Arts: "Why Arts Integration" <https://www.wolftrap.org/education/arts-integration-early-childhood/why-arts-integration.aspx>