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Complicating STEAM: A Critical Look at the Arts in the STEAM Agenda

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Introduction

This entry offers a critical perspective of the role of the arts within the popular STEAM agenda. Most loosely defined, STEAM can be understood as incorporating the arts into the STEM (science, technology, engineering, and mathematics) acronym for the purpose of introducing a focus on art and design into these four subject areas. This entry first questions what the A in the STEAM acronym actually represents. The entry then argues that a focus on any discrete set of disciplines prioritizes some domains of practice, while overlooking others. The entry goes on to encourage a more distributed approach to pedagogical practice that is less about establishing catchy acronyms that privilege some disciplines over others – and more about supporting young people and adults in becoming multimodal learners capable of making connections between and beyond the disciplines.

Understanding STEM to Understand STEAM

For many in the education field, pursuing STEAM as an approach to curricular design and instruction has been identified as an important goal to support young learners for life and work in the decades ahead. Most loosely defined, STEAM means incorporating the arts into the STEM (science, technology, engineering, and mathematics) acronym for the purpose of introducing a focus on the arts and design into these four subject areas. But in order to understand STEAM, it is important to first understand STEM. More than just a collection of disciplines, STEM suggests the integration of the sciences, technology, engineering, and mathematics into a learning experience in a synergistic way that blends the disciplines together, rather than engage with them separately.

The most commonly referred to turning point for the focus on STEM within the educational sphere was the Soviet Union's launch into space of the world's first artificial satellite, *Sputnik 1*, on October 4, 1957. The launch of *Sputnik 1* triggered an international race to invest in expertise that would lead to innovations and new technologies. In the early 2000s, science, technology, engineering, and mathematics were identified by many as important disciplines needed for the development of just such innovations and technologies (Xie et al. 2015). It was around this same time

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that the National Science Foundation in the United States introduced the STEM acronym and declared their efforts to promote innovation and technology in education to further support the prosperity and advancement of the country. Since then, many of the world's educators, social leaders, and policymakers have identified proficiency in the STEM subjects as being critical for success in the twenty-first century. Though the STEM acronym is frequently used to refer to the knowledge and skills associated with these four disciplines, the acronym has also been said to be insufficient in describing the full breadth of disciplinary knowledge and skills that young people will need to be successful today and tomorrow. This has led to new perspectives on the STEM acronym in the past decade.

Adding an "A" to STEM to Make STEAM

As interest in STEM education rose in popularity, a further interest in adding the arts to the STEM disciplines spawned STEAM (see for example, Maeda 2013; Yakman 2008). While many arts education advocates have championed the STEAM cause, others remain skeptical. Educators and academics alike struggle to clearly articulate what STEAM is as a concept, and what that concept looks like in practice. In some cases, descriptions of STEAM position the arts as a handmaiden to the STEM disciplines, treating the arts as an on-ramp or entry point to STEM learning. In other cases, the arts are used ornamentally, as a decorative moment to complete an otherwise robust STEM learning experience. In both of these cases, a deep engagement in the arts is lacking, and the STEM disciplines take priority over the arts in the learning experience. In other cases, the A in the STEAM acronym does not stand for the arts at all, but rather stands for creativity – introducing the spirit of imagination and innovation to STEM learning (Clapp and Jimenez 2016). It should be noted that many STEM professionals take issue with this last argument for introducing the A to the STEM acronym, as it suggests the STEM disciplines lack a sense of creativity and are dry subjects with no opportunity for imagination and invention. From this perspective, the STEM disciplines foster creativity all on their own, and no additional A is necessary.

STEAM and the *Alphabet Souping* of Teaching and Learning

In addition to the ambiguity associated with the STEAM acronym, there is another phenomenon in the field of education that can best be described as the *alphabet souping* of teaching and learning. Here, not only is an A added to STEM to make STEAM, but an R for Reading, wRiting, Research, and/or Religion may be added to make STREAM. An additional M can be added for Making to make STEAMM, or a Y – for Yoga – added to make STEAMY or STREAMY or STREAMMY.

Despite the inherent wit involved in adding letters to the original STEM acronym, many have found that adding letters to an already overcrowded acronym does little to describe what teaching and learning looks like in practice. As such, extending the STEM acronym serves more as an act of advocacy for particular disciplines and professions, and serves less as an act of pedagogical design.

STEAM's Bias Towards Some Disciplines at the Expense of Others

While the *alphabet souping* of teaching and learning associated with the STEM- and STEAM-related acronyms is cause for confusion, there are also serious concerns that all such acronyms are inherently biased towards some disciplines at the expense of others. Many STEM- or STEAM-related acronyms overlook the wider breadth of subjects associated with the humanities. At times, it may be the case that an oversight of the humanities is quite intentional, as the humanities are viewed by some as being less useful (and less profitable) disciplines for life and work in the

twenty-first century. Nonetheless, restricting learning opportunities to a focus on any set number of disciplines limits learning in a way that may disadvantage young people. As educators and researchers seek to define and characterize STEAM, some have started to explore a transdisciplinary approach in which the integration of the arts into the STEM disciplines offers a completely new way for learners to address and solve real-world problems. This transdisciplinary space can feel constrained when limited to only five letters amongst the many others that can help students explore and explain solutions to the puzzles and challenges they will face today and tomorrow.

To address this issue, it is essential to further explore not just the disciplines that compose the STEAM acronym but the prospects for thinking and learning that STEAM is said to offer. Those who see the prospects of STEAM as stretching beyond disciplinary knowledge and skills have articulated a host of benefits that quality STEAM learning may offer. These benefits often include the popular arts education advocacy talking points, which largely overlap with the 4Cs (creativity, critical thinking, communication, and collaboration and teamwork) and the personal and social skills associated with the framework for twenty-first century learning. But, yet again, such skill sets are not unique to the arts, and engagement in quality STEM learning without the arts is likely to foster these outcomes as well.

Multimodal Thinking – Finding Opportunity Between and Beyond the Disciplines

Perhaps what is of greater interest as a STEAM learning outcome is the *multimodal thinking* that any variety of quality interdisciplinary, multi-disciplinary, or trans-disciplinary learning experience may offer. Engaging in project-based, problem-based, design, or maker-centered learning that requires one to interact with the knowledge and skills associated with several disciplines prompts learners to make connections across diverse domains of practice. A multimodal thinker may have expertise in a particular suite of disciplines, but when addressing complex problems, she or he does not limit herself/himself to those disciplines, but rather thinks more broadly about how to access the necessary knowledge or skills that may be needed to solve a problem. From this perspective, the true benefit of being a multimodal thinker is not to develop knowledge and skills in a given set of disciplines, but rather to develop the *dispositions* necessary to make connections to various domains of practice – and to find opportunity between and beyond the disciplines. One may argue that, rather than being limited by a given set of disciplines in an acronym, multimodal thinkers have the potential to excel within any domain of practice, or – in particular – within the burgeoning twenty-first century careers and professions that will call for individuals who have the ability to not merely think in terms of discrete sets of disciplines, but rather to think between and beyond the disciplines.

Given this argument, the limitations of STEAM lie within the acronym itself. With an overemphasis on the disciplines, STEAM learning experiences restrict the potential of young people and adults who may be better served by learning experiences that promote more unbounded multimodal thinking. This is the core tension of the current STEAM debate. Indeed, there seems to be an interest in education that privileges particular disciplines (and particular professions), yet there is also an interest in preparing young people to be equipped with the skills necessary to be multimodal thinkers across domains of knowledge. The concept of equipping young people to operate in a space that encompasses all of the disciplines – not just a select few – is an important one for STEAM advocates and educators to consider. Disciplinary learning will come, when disciplinary knowledge and skills best serves the learning objectives at hand. Ideally, the STEAM classroom functions as a nimble space where multimodal learning takes place, and where young people develop the dispositions they need to think, learn, and invent in a complex world.

References

Clapp, E. P., & Jimenez, R. L. (2016). Implementing STEAM in maker-centered learning. *Psychology of Aesthetics, Creativity, and the Arts, 10*(4), 481–491.

Maeda, J. (2013). STEM + art = STEAM. *STEAM Journal, 1*(1). https://doi.org/10.5642/steam.201301.34. Retrieved from: http://scholarship.claremont.edu/steam/vol1/iss1/34.

Xie, Y., Fang, M., & Shauman, K. (2015). STEM Education. *The Annual Review of Sociology, 41*, 331–357.

Yakman, G. (2008). STEAM Education: An overview of creating a model of integrative education. Graduate student thesis. Virginia Polytechnic and State University. Retrieved from: https://www.researchgate.net/publication/327351326_STEAM_Education_an_overview_of_creating_a_model_of_integrative_education.

Further Reading

The STEAM Journal. Claremont: Claremont Graduate University. Retrieved from: https://scholarship.claremont.edu/steam/.