Musing on Unanswered Questions

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EXECUTIVE SUMMARY

Out of a conversation between two long-time colleagues—each a science educator and practicing artist, emerged the question, "What does it mean to STEAMify a lesson, and why would a teacher actually choose to do such a thing, other than, say, for-grant-writing-purposes? Their science selves really liked the idea of a STEAM system, acted upon by forces, both from the outside and from within, and with energy flowing and cycling, all the while transforming grey matter in ways that sustained the teaching/learning process. When it came to their art, however, their dialogue followed pathways grooved by long years of practice and hard work in their respective fields. One author is a seasoned vocalist, trained in the nuances of both individual and group vocal performance as well as the attendant dimensions of music, its composition and phraseology. The other is a painter, poet, and novelist, shaping words, color, and line to tell stories and communicate ideas. What was significant to each was that their artistic habits of mind had shaped their axiology, transforming their ways teaching.

INTRODUCTION

Why should just one more in an interminable line of educational acronyms or slogans actually matter? Is STEAM really *different*, or is it another fad? That the idea of STEAM has even emerged in the first place implies some underlying and global lack of creativity and imagination in both science and STEM education; and yet, we have personally observed many such teachers employing highly artistic teaching styles, flexibly improvising to adapt to changing situations and student needs and driving home the message that in the end (as Eisner has said), education is the act of inventing yourself through hard work, practice, failing, and trying again. There is no kit with instructions for the making of the self. Such an effort begins with and is sustained by the individual. We are calling for a kind of STEAM education that develops the habits of mind associated with making art, which includes the practice of critique and care throughout the learning/making process. Such STEAM educators would recognize that what educators Hetland, Winner, Veenema, and Sheridan (2013) describe as "studio thinking" are highly congruent with the Science and Engineering Practices (NGSS Lead States, 2013). Figure 1.

We advocate for a kind of STEAM that builds in time for critique to help students learn to observe, interpret, explain, and evaluate (Hetland, Winner, Veenema, & Sheridan, 2013). Through the imagery of musicianship— be that improvisation, composition, or the interpretation of its performance—we will introduce a model of teaching science as aesthetic inquiry that we think can move students away from alienation and towards affiliation with science and STEM education. Our aesthetic model foregrounds knowing as communal and value-laden, rather than as a static, detached, objective process of naming and identifying. Aesthetic inquirers recognize that the creative process (always present at the heart of science) spirals outward through cacophony and chaos, and that neat, harmonious compositions may not

Figure 1. Comparison of art studio habits of mind and NGSS science and engineering practices