Successful STEAM: Designing art-science activities with equity and access in mind

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EXAMPLE OF PRACTICES IN ACTION: PAINTING WITH CHEMISTRY

Overview

STEAM is hot right now, but best practices for the field are still nascent. Our team developed and implemented a five-year, NSF-funded project that offered STEAM summer academies to pre-middle school girls in museums and other informal settings. Through this project, we articulated a set of core STEAM practices and developed design recommendations for those wishing to support science and art learning (including identity development) through STEAM activities.

Science concepts: acid and base chemical reactions; color indicators

Open exploration: curiosity-driven "messing around" to explore learner questions

Designing with intention: creation of color palette through chemistry experimentation

Core STEAM practices

1) Leveraging science concepts to create artwork
2) Focusing on outcomes that have a personal and/or aesthetic meaning
3) Conducting open exploration in the context of both art and science
4) Designing with intention (e.g. choices around medium, use of genuine science and/or art tools)
5) Iterating through several drafts, prototypes, or models
6) Communicating about process and outcome

Why this approach?

Activating interest and personal relevance sets youth on a path for developing life-long science engagement. Our STEAM model stresses *leveraging science concepts* in the service of creating art that has an *aesthetic or personal meaning*.

We also know that youth become extremely self-critical of their own art around late elementary school age, and can stop participating as a result. Our STEAM practices can quiet the "inner negative voice" and allow youth to fully engage.

Personal expression: learner design of watercolor composition

Iteration: results feed back into new designs

Communicating process and outcome: presentation to peers

Design Recommendations

1) *In designing a STEAM activity, draw on disciplinary practices of both science and art.* Start by articulating which disciplinary practices and concepts will be represented. Verify that both science and art practices are included. Focus on process rather than product.

2) *Create spaces and places that offer opportunities for learners to engage in meaningful STEAM practice*. Give opportunities for learners to use and/or create genuine science and art tools, engage in open exploration rather than rote practice, and make the space their own.

3) *Use strategies that tackle the "inner negative voice" that can limit creativity and the willingness to engage or try.* Explicitly address the existence of the inner negative voice. Talk to learners about how it can shut down creativity. Include opportunities for iteration, so that learners have more than one opportunity to achieve a desired outcome. Break down tasks into manageable chunks, and employ meaningful constraints around challenges.

4) *Use practices that promote identification with science among diverse learners*. Illustrate how the content of your activity connects to everyday life. Give learners choices that promote agency and a sense of learner control. Position youth as emerging experts, through, for example, dialogue with experts and/or peers.

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