

The Arts in STEM: Designing a Musical Instrument with Recycled Materials

As the capstone requirement for the Endeavor STEM Leadership course and program, a professional development (PD) presentation was designed and delivered based on the integration of arts in STEM. The topics covered in the PD started with the basic breakdown of Science, Technology, Engineering, and Math, and how they all work together within STEM. This was a more introductory type PD, as the audience of teachers did not have a strong background in science or STEM in the classroom. The presentation then shifted into the main topic of the PD, which was art integration in STEM.

Unfortunately, due to the current health crisis, the previously scheduled live PD session did not occur, as NYC schools moved to remote learning before the scheduled date. The school where the PD was meant to occur is PS 48 in Washington Heights, New York. It is an elementary school comprised of classes from pre-kindergarten through fifth grades. The educators who received the prerecorded presentation remained the same as the originally intended audience, as the presentation was geared towards their experience levels and interest in STEM implementation in their classes.

This PD covered science, math, and arts' standards. Additionally, teachers were shown various ways that ELA standards can very easily be integrated into this project, depending on the process and final product. The following are standards applicable for the engagement activity:

Science:

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Math Practices:

MP.2 Reason abstractly and quantitatively.

MP.4 Modeling with Mathematics.

MP.5 Use tools strategically.

ELA:

5W6 Conduct research to answer questions, including self-generated questions, and to build knowledge through investigation of multiple aspects of a topic using multiple sources. (3-5-ETS1-2)

5W8 Recall relevant information from experiences or gather relevant information from multiple sources; summarize or paraphrase; avoid plagiarism and provide a list of sources. (3-5-ETS1-2)

Arts:

Visual Arts: Creating

ANCHOR STANDARD 2: Organize and develop artistic ideas and work.

Enduring Understanding 2.1: Artists and designers experiment with forms, structures, materials, concepts, media, and art-making approaches.

VA:Cr2.1.2a: Experiment with various materials and tools to explore personal interests in a work of art or design.

The purpose of this professional development presentation was to both introduce STEM and STEAM to a group of elementary school teachers and to give them an engaging activity that is easily implemented into their classroom. The requirements of this school and district, like so many, are quite strict and time-filling. Teachers have stated they do not feel motivated to introduce any STEM activities due to a lack of time, knowledge, and resources. This PD was, therefore, intended to help lessen their mental burden of figuring out how to easily and effectively introduce STEM into their classrooms, while integrating art to help engage all students.

The professional development training began with a brief introduction and breakdown of the STEM components, as the teachers who “attended” had limited experience with STEM concepts. The presentation then moved into adding arts into STEM to create “STEAM”, and how that could be an engaging way of easily implementing and introducing STEM into their classrooms. The focus then shifted to the

cross-disciplinary approach, making STEAM feasible, and effective, even with all their other curricular obligations. Content areas and standards were touched upon that were specific to the following activity.

The final portion of the PD was dedicated to discussing, and participating in, the active engagement portion of the activity. The process of classroom implementation, from beginning to end, was covered, including areas of differentiation. Possible materials and parameters were covered, including age-appropriate options. Emphasis was placed on working through the engineering design process with their students to ensure they understood the importance and fluidity of each step in the process. Possible obstacles and troubleshooting tips were briefly covered to remind the teachers how going through this activity first, on their own, could assist with recognizing areas where their specific students may need differentiation or options. This activity was meant to be the bulk of the presentation and experience, and hopefully the teachers will take the time to go through this activity on their own after watching the presentation and share their creations and feedback.

The Endeavor resource included in this PD presentation was directly borrowed from The Arts in STEM course. Within this course, participants learned about and participated in creating their own recycled musical instruments. Endeavor was included as a reference and resource at the beginning and end of the presentation.

Since this PD was not able to be delivered in person, and due to the remote learning continuing for the remainder of the school year, the follow-up activities were limited and altered from the original proposal and plan. Surveys were meant to be given two weeks post-PD, to receive feedback from the presentation, and to see how and if the teachers implemented this activity into their classrooms. At this time, as teachers are on very different schedules while they teach remotely, there is no organized timeframe for follow-up activities. Next academic year, while months away, could be a potentially successful time to reintroduce this topic and activity and offer consistent support and follow-up activities.

Since the professional development presentation was not carried out as originally planned (through no fault of anyone), there are no survey results or quantitative data available. However, the author and presenter can reflect upon aspects of the professional development.

It is currently difficult to determine the “success” of this professional development, as no data or feedback has yet been given by participants. Yet, the content delivered in the presentation was based on both the previous experience of the author, combined with credible resources and organizations, giving the content of the PD strength. The lack of an in-person presentation decreased the effectiveness of such content and information, as the natural back-and-forth discussion that occurs in live seminars assists with content comprehension and idea expansion. Without this immediate and scheduled feedback, the PD effectiveness is very difficult to gauge. According to a study by DeSimone in 2011, “For almost any study, no matter what the design, we have to decide how to measure teacher experiences, learning, and instruction. Observations, interviews, and surveys are the most common ways to collect such data” (pg. 70).

This professional development presentation was created to assist teachers within a large city elementary school develop the confidence and capacity to introduce one new form of instruction and learning for their students. Given the diversity within the school, including multiple languages and a large population of students in special education, learning how to implement STEM and STEAM into the classroom could greatly assist with student engagement and success, due to its hands-on, interactive nature. Yet, given the large amount of school and district requirements, professional development is rarely, if ever, focused on subjects other than ELA and math. “Guskey and Peterson recognized that teachers work under demanding conditions that make it difficult for them to develop expertise in the most current ideas and research on student learning. What often happens, then, is the failure of teachers to use current or accurate information to conduct school improvement, potentially leading to sporadic and limited

positive change in student performance” (Kaniuka, 2012). Adding in current and progressive professional development experiences for these teachers and schools is a critical element in assisting their diverse learners to have greater success by increasing their overall interest and engagement within the classroom. The author will ensure that even though the current world situation has not enabled them to directly work with their colleagues on an area of importance for their school, future trainings and activities will take place. Although this is one small presentation in a plethora of trainings and school requirements, assisting even a few teachers with understanding new content and how to implement STEM activities into the classroom can have a lasting ripple effect. Once students, and teachers, catch “the bug” of STEM and STEAM, engagement in both instruction *and* student learning will increase, and a livelier classroom experience will be had by all. The author’s STEAM PD can assist these teachers in understanding the activity and content, and offers sufficient resources and tips on how to easily begin implementing these activities into the classroom.

References

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Kaniuka, T. S. (2012). Toward an understanding of how teachers change during school reform: Considerations for educational leadership and school improvement. *Journal of Educational Change*, 13(3), 327–346. doi: 10.1007/s10833-012-9184-3