The STEAM Journal

Volume 3
Issue 1 *Sediment*

Article 7

November 2017

Using STEAM to Increase Engagement and Literacy Across Disciplines

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STEAM is a bi-annual journal published by the Claremont Colleges Library | ISSN 2327-2074 | http://scholarship.claremont.edu/steam

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Abstract
This paper explores STEAM as a solution to improving student engagement and helping students improve functional literacy across the curriculum. While STEM is a fairly established approach to curriculum, researchers and practitioners are continuing to develop and understand STEAM and its place in school curriculum. It is important that educators foster this holistic approach to education and strive to participate in active research associated with STEAM. It is also most advantageous for stakeholders to understand the importance of arts integration and its use to support collaboration, innovation, and creativity within students. Key strategies can be used to support arts integration in any classroom.

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Keywords
STEAM, arts integration, literacy, technology

Cover Page Footnote
Using STEAM to Increase Engagement and Literacy Across Disciplines Stephen Davis & Robert L. Long II Carson-Newman University Author Note Stephen Davis & Robert L. Long II, Department of Education, Carson-Newman University. This research was compiled for Education 637: Expertise in Education-Topics in Content Field

Using STEAM to Increase Engagement and Literacy across Disciplines

Stephen Davis & Robert L. Long II

Introduction

Teaching STEM and sustaining arts education will lead to the creation of innovative products and propel our economy forward (Maeda 2012). STEAM is the answer to developing problem solving, fearlessness, and critical thinking and tactile skills that our country needs (Maeda 2013). Using art can improve students' designs, presentations of their material, and increase the effectiveness of their creative planning (Bishop-Wisecarver, 2015).

The goal of implementing STEAM curriculum is to provide a holistic education that engages both sides of the brain, develops students' functional literacy across the curriculum, and promotes constructivism. Through the implementation of STEAM, students are given the opportunity to explore different concepts through real world activities that improves their strengths (Catchen, 2014). It can also be used to overcome their weaknesses (Catchen, 2014). Students' exposure to arts integration has the potential to affect their learning and memory, ability to collaborate, and creative problem-solving skills by providing deeper engagement in subject matter, promoting better retention of content, and fostering emotional involvement in the learning process (Hardiman, Magsamen, McKhann, and Eilber, 2009). Music education supports the STEAM movement by developing key skills (e.g., self-reflection, communication, collaboration, creativity, and innovation) in students and closes gaps in student learning (Naithram, 2014). Music is an ideal tool and methodology for emotionally engaging and teaching students in the core subjects of STEM and prepares students' minds for complex ideas and thought processes (Fitzpatrick, 2014). A STEAM curriculum can propel a rigid, left brain only

curriculum into a malleable, whole brain, sustainable curriculum that leads students to be engaged, empowered, and thinking about their education's real world applications (Jackson, 2015).

Learning happens through the accumulation of knowledge, collaboration of knowledge between people and organizations, changes in self-perception as new knowledge and skills are acquired, and other people's changing perceptions of the learner (Radziwill, Benton, and Moeller, 2015). The arts support the process of learning by teaching students how to observe and envision and gives students empowerment and satisfaction through the process of creating (Yokana, 2014). Creativity is metaphorical in nature because it creates connection between two dissimilar ideas and is highly important in the sciences; creativity connects the unknown with the known (Ramirez, 2013). The student-centered nature of STEAM cultivates innovative talents by teachers encouraging students to question and reflect and guiding students to innovation-oriented issues (Huichen and Xiaoting, 2016).

STEAM and Literacy

Our schools are charged with the responsibility of producing literate students who can critically and abstractly. For this effort to be successful, English Language Arts (ELA) teachers should collaborate with their math and sciences colleagues to develop student literacy (Buckles-Stie, 2013). Literacy occurs through the process of learning (i.e., deliberate procedure of gaining knowledge) and acquisition (i.e., gaining knowledge through observation, exposure to modelling, imitation, and trial-and-error. Relationships and convergences are found in five domains (e.g., CCSS E2, E5, M2, and M3) of common core state standards in math, science, and ELA (Cheuk, 2013). It is imperative that these standards are covered to ensure full mastery throughout the subject areas. These standards can only be mastered and used as functional literacy by students

through the usage and practice of an integrative approach. It is over equal importance for students to be able to think and create innovatively as well as read complex text, effectively convey their ideas. This reality denotes ELA curriculum as our hypothetical adhesive that helps hold and connect all subject areas in STEAM together. It is the responsibility of all educators to continually provide ELA experiences to effectively improve literacy among a student population (DeBoer, Carman, & Lazzaro, n.d.). Likewise, ELA classrooms should use STEAM integration to give their students purposeful, authentic, real-world experiences to prepare them to be college and career ready.

STEAM and Technology

Technology allows students to combine literacy research, science concepts, geography, engineering principals, and art design into a cross-curriculum content activity (Unawecro, 2016). Technology can be a creative tool used by teachers and students in different content areas, and includes art programs such as animation and three-dimensional modeling (Olejarz, 1996). Students can create and design presentations using different computer programs (Krigman, 2014). For examples, students explore art from other cultures and then create an interactive mural identifying mathematical concepts found in that artwork (Krigman, 2014). Technology allows students to combine different content areas into a student-designed presentation on a specific topic in order to demonstrate a deeper understanding (Herro & Quigley, 2016). Students are able to use art education and digital technology when completing content area activities in order to develop their artistic creativity, using film to develop critical thinking skills (Heeron, 2013). Students use artistic thinking to develop buildings, atoms, DNA models, and robotic designs using computer graphic programs (Herron, 2013). Students can then further use

technology to share, critique, and mentor with other peers and mentors in different classrooms, schools, and cities (Herron, 2013).

Technology has changed the way classrooms are set up and has allowed classrooms to enable more collaboration in the classroom through devices such as interactive displays, collaboration programs, digital devices, etc. (Winske, 2016). Video conferencing allows classrooms to connect with other classrooms around the world, making it easier for students to learn about other cultures and art without expensive traveling (Winske, 2016). 3D printing gives students the flexibility to show, learn, create and demonstrate concepts in a hands-on fashion that is lacking in traditional books and classroom materials (Krassenstein, 2014). 3D Printing is not limited to just one content area, but allows students in different content areas to print out designs, ideas, and materials for different student-led activities (Krassenstein, 2014). Other technologies used in classrooms to promote student engagement and improve learning include Edmodo, GIZMO's, and computer programs such as Google Classrooms (Herro & Quigley, 2016).

Technology gives students the ability to manipulate text in order to better learn words and sounds when working on their literacy skills (Roos & Lambert, 2016). Students working to improve their reading/writing skills can use technology to read aloud their text, and adjust the text to read at the students' pace in-order to increase their reading fluency and understanding (Roos & Lambert, 2016). Technology additionally allows for computers programs that students can use to manipulate graphics, sounds, and animations in order to motivate themselves and encourage students to focus on their reading skills (Roos & Lambert, 2016). Computer programs also allow for comprehension activities to be tailored to the students' levels; programs such as spell check, word prediction software, graphic organizer programs, and voice recognition software help struggling writers and reader to improve specific skills (AdLit, 2010).

Technology allows for an unprecedented level of flexibility and differentiation for the different learning levels and styles of students (Boundless, 2016). Podcast and Vodcasts allow for the student to rehear and see lessons from the classroom at their own paces (Boundless, 2016). Additionally, technology helps the classrooms to move away from a 'lecture style' and more to a student-led style that can cater to different learning styles and paces. (Boundless, 2016). Programs such as Edmodo and Google Classroom enable teachers to respond quickly to student work and messages concerning student questions and help (Herro & Quigley, 2016).

Implementation and Strategies

For arts integration to be successful, students should see connections and take away big ideas, arts activities must genuinely connect to the academic curriculum, content and artistic lessons should be of equal importance, experiences should include assessments with rubrics, and lesson plans should contain state curriculum standards for content areas and the arts (Mishook and Kornhaber, 2006). Through planned collaboration, teachers can provide deep coverage of their content area and reinforce what is being taught in other content areas; this will lead to students developing functional literacy that will allow them to learn and adapt in diverse learning environments. To turn STEM into STEAM, teachers should be provided with time for collaboration, be provided with adequate training, welcome cooperative learning, find other like-minded educators, study STEM and arts standards, and advocate (Weber, 2014). STEAM lessons can become confusing to students if not properly developed (Riley, 2013). To plan integrated studies, make sure that lessons are structured with final goals and be open to allowing your students to experience the learning process; in many cases the best experiences are unplanned (Nobori, 2011).

Strategies such as mirroring (i.e., students using drama and dance to share understanding), stepping into the painting (i.e., using visual arts to interpret personal meaning), and call and response (i.e., using music to practice fluency) can be used to implement arts integration (Riley, 2012). PBL is an ideal tool to use with the STEAM design because it encompasses creativity, collaboration, critical thinking, and communication (Miller, 2014). When implementing arts integration, teachers should practice the WAIT method (i.e., teachers experiment using arts casually *with* their students, teachers have students to do creative projects *about* and *in* the arts to develop personal artistry, after creating daily routines, teachers teach their content area *through* the arts (Kuhn, 2015).

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