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# PERFORMING ARTS AS AN INTEGRATED METHOD FOR TEACHING STE(A)M CONCEPTS TO MIDDLE AND HIGH SCHOOL STUDENTS

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# Performing Arts as an Integrated Method for Teaching STE(A)M Concepts to Middle and High School Students

**Synopsis**:

Successfully pairing performing arts with STEM (STEAM) subjects to engage students in the topics of Marine Science, Ecology, and Climate Change at the Middle and High School level.

# Performing Arts as an Integrated Method for Teaching STE(A)M Concepts to Middle and High School Students

## Author Note

The programs were sponsored by the Northern Gulf Institute at Mississippi State University and undertaken with the support of the Mississippi State University Department of Communication, Gulfport High School, the Mississippi Aquarium, and Dauphin Island Sea Lab.

Press Coverage Concerning the Northern Gulf Institute and Gulfport High School; Theatre for Change Collaboration "Hello Opportunity" can be found here: https://www.youtube.com/watch?v=Ylpt5zaJ-1s , and here https://www.ngi.msstate.edu/site/portal/view.php?s=99 and press coverage for the Northern Gulf Institute, MSU, MS Aquarium and Dauphin Island Sea Lab STE(A)M Collaboration "Banner – A sea Turtle Saga" can be found here: https://www.msstate.edu/newsroom/article/2021/11/banner-sea-turtle-saga-aims-help-children-learn-about-marine-environment#:~:text=The%20play%20tells%20the%20story,oil%20spills%20and%20climate%20change

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## Abstract

Originally intended to begin in 2019, The Northern Gulf Institute and its partners developed a series of STE(A)M based collaborations with award-winning, Theatre for Young Audiences playwright Tonya Hays, to create original plays with music, as traveling, teachable outreach projects, USING performing arts to teach STE(A)M topics, focusing on the subject of climate change and its potential impacts on the Gulf Coastal region. The program included student research into STEM topics, visiting lectures from STEM Scientists, field trips for students to take part in hands-on, experiential learning opportunities in STEM fields, as well as student generation of educational materials and teaching packets for the travelling shows and attendees. Each viewing of the play was followed by a brief lecture and Q&A concerning the truths and scientific concepts behind marine science, marine biology, tropical meteorology, pollution, climate change and climate science in a manner intended for it greatest possible impact on young audiences.

The initial project "Hello Opportunity" created by Hays and the Advanced Theatre class from Gulfport High School in Gulfport, Mississippi, was followed on by the "Banner – A Sea Turtle Saga" developed as a collaboration between the Northern Gulf Institute, The Mississippi State University Department of Communications, the Theatre MSU Program, the Mississippi Aquarium, and the Dauphin Island Sea Lab, to create a second original musical theatre production, as a traveling, teachable outreach project, on a larger scale than the "Hello

Opportunity" project, focusing on the dangers marine animals and the environment face due to plastic pollution, oil spills, severe weather events, and climate change.

## Introduction

It has long been known that ARTS and Art instruction has been a key factor in children's development of problem-solving skills, via the presentation of difficult concepts through more easily understood visual or auditory channels. "A picture is worth a thousand words" after all. It has also been demonstrated that art instruction aids in development of language and social skills among younger students as well as enhancing fine motor skills and enhancing decision-making abilities, inventiveness and "authentic expression" (Dewey, 1909) all while integrating concepts of visual design and layout that continue to grow in importance in both visual and in digital presentations commonly used in modern education and working environments (Catterall, 2012).

Traditionally, STEM fields have included Science, Technology, Engineering, and Mathematics until, in 2013, when United States House of Representatives officially introduced a joint resolution expressing the sense that adding art and design into Federal programs that target the STEM fields encourages innovation and economic growth in the United States. This resolution altered the traditional STEM meanings to include arts as STE(A)M fields, which include science, technology, engineering, ARTS, and mathematics. STE(A)M integration at this time was intended to integrate STEM subjects and the arts into the American education system at a time when creativity and the arts were being pushed to the wayside by school administrations wishing to teach only to the "test", in an effort to bolster standardized test

scores, educational performance and school rankings. In this case, the underlying and potentially damaging impacts on creativity and scientific progress could be felt through the nation, almost immediately.

The omission of arts education from a school's curriculum is harming students' abilities to broaden their overall knowledge to allow them to function better in society. Our community must ensure that our future generations have acquired the proper information to positively influence the relationships that help to shape our communities and cultures. The inclusion of an arts education in a curriculum has enhanced student performance in core subjects such as math, science, and language while still allowing those students to acquire the information needed to succeed within their communities. The removal of arts education from our schools fails to ensure that our students develop both empathy and the broad knowledge required to make positive decisions within their community. The benefits gained through arts-integrated education, such as better performance in core subjects and becoming more cultured, far outweigh the benefits of their exclusion for improved standardized testing outcomes.

**Benefits of and Need for Arts Integration in Education**

Many schools in today's climate fail to incorporate arts education into their curriculum, often ignoring them entirely. Many schools are not hiring art teachers and refuse to allocate money to develop a successful arts-integrated learning environment. Studies have shown that schools with less importance to arts education and a greater emphasis on high-stakes testing produce fewer civic participants. Grahams' article "The Effects of High-Stakes Testing on Elementary School Art, Music, and Physical Education" argues that the arts and art programs

regularly suffer from increased pressure to perform better on standardized tests. In many cases, schools have reallocated time originally intended for arts programs, instead to core subjects like math, science, and languages to improve their performance on those high-stakes exams. It may "seem" logical to reduce the importance of coursework some consider "unnecessary" to raise standardized test scores. Still, there is little to no evidence of the effectiveness of these steps on testing outcomes (Graham et al., 2002). One particularly public example was former Mayor Michael Bloomberg of New York City, who implemented and enforced an accountability testing system on public schools to test students on core subjects to determine a school's "effectiveness" because of this program, schools in New York City began to feel an increased pressure to perform well on those high-stakes exams. To improve their test scores, those schools began to reallocate time solely to the core courses to ensure they were not placed into receivership or closed entirely. This action reduced the ability of students from those systems to fully contribute to their community. In this manner, nationwide, schools are restricting the full potential education of their students through the removal of arts and art integrated classes and programs, thereby hindering the potential of those students from rising to their full productive potential (Yee, 2014). Much of these reductions to arts programs directly result from the official "No Child Left Behind" policy, which gives greater importance to core subjects such as math, reading, and writing. In this case, arts education has been deemed as less important, and the testing of the core subjects used to determine the school's adequate yearly progress all but ignores the arts. This system often determines the budgets schools will have to work within the following year, with poor testing outcomes leading to significant budget cuts and punitive burdens to the faculty and administration. Consequently, these

budget cuts often lead to the removal of art departments, programs, and classes because schools consider them to be "unnecessary" electives and, therefore, less critical. When the pressure to perform well on these high-stakes exams is combined with budget cuts, this causes arts education to suffer in schools and is either minimized or wholly dismissed from curriculums. (Beveridge, 2009). As a society, we simply cannot allow this to happen. This concept is the driving force behind the integration of arts fully into the STEM fields as an integrated STE(A)M program.

**Initial Project Conceptualization**

The idea was conceptualized and funded through Federal Task I funds from the Education & Outreach program of the Northern Gulf Institute, a NOAA cooperative institute housed at Mississippi State University, in response to requests by regional school district faculty and students, for face-to-face involvement of Earth, Atmospheric, Biological and Marine Scientists with the public, through local schools, children's, museums, science centers, aquariums and civic organizations. It was seen as a way to reach hundreds (potentially thousands) of participants throughout the region as a travelling arts program designed to teach STEM/STE(A)M concepts to regional students and stakeholders. The project was designed to incorporate a student-centered, faculty guided, performing arts and design program, from initial design to implementation, which would include not only the artistic components but the educational and scientific components such as Interactive teacher packets and science and art curriculum designed to support the content. Educational material was created with support of

educators and curriculum designers from the Mississippi State University, College of Education, as well as the assistance of local and regional teachers in arts and science programs within Mississippi, in order to meet the needs of regional educators and to follow the Mississippi college and career readiness standards (CCRS) set out and adopted by the Mississippi Department of Education.

( https://www.mdek12.org/OAE/college-and-career-readiness-standards )

The program utilized scientists, writers, artists, and musicians acting as mentors to students involved with the project, in order to create and fully involved learning process for not only the students who observe the programs but also to those that participate and help to create the learning opportunity.

**"Hello Opportunity" Program**

Originally created as a collaboration with the Gulfport Highschool Theatre and Science Departments, to create an award-winning touring production to help regional students to understand the potential environmental and socio-economic threats posed by climate change. The idea was achieved through a partnership with an internationally recognized children's playwright, who took STEM/STE(A)M concepts as described in the national college and career readiness standards and presented them to students in regional schools in such a manner as to make the ideas more understandable and less frightening, while providing the students with scientifically accurate talking points and information from which they, as the future leaders, can move forward with an understandable dialogue. The "Hello Opportunity" program was created

from an idea stemming from an original musical titled Hello Opportunity recorded by Aubrey Hays


*Figure 1: Cast and Crew of Hello Opportunity at the Mississippi Theatre Festival*

The song was inspired buy the final good bye of the NASA scientists as they powered down the Mars Rover, Opportunity. The play took place in dual places, on Earth, in the past, portraying the struggle of scientists to combat catastrophic climate change and in the future with colonists of Mars. A character called Cassandra, a transhuman, bridged the gap between time and place. The play ends with several of the colonists, led by the younger generation, choosing to return to the Earth and continue the work of the scientists who had passed on.

Hello Opportunity was written for audiences at the high school level and up. It resonated with students and the older generation as well.

The production was followed by talk backs led by scientists. Audience members were egnaged and inspired to do more research on their own. The discourse provided thoughtful discussion of what was happening to the climate ,as well as inpiration for artists and audiences to find ways to consider their own impact on the environment.

This project involved not only an artistic approach (STE(A)M) to science but also traditional science (STEM) class lectures on related topics by NOAA/NGI field specialists. The Hello Opportunity project won several local, regional theatre awards including best original work for 2019 and moved up to the State-Level theatre competition (Mississippi Theatre Association), where it won Best "Theatre For Change" project. It also was awarded the "Outstanding Impact Award" from the Educational Theatre Association. The project was subsequently invited to participate in "Story-State" at Mississippi State University. https://www.youtube.com/watch?v=Ylpt5zaJ-1s

This project fostered a high level of interest, both socially and in STEM/STE(A)M career development, especially from coastal schools and students, on the topics within which environmental and climate science is based. It reached an estimated 1400 viewers with interest being generated for publication and production at schools on the national level.

**"Banner - A Sea Turtle Saga" Program**

The "Banner" project written by Tonya Hays an assistant professor at Mississippi State University, with an interest in theatre for young audiences, and a passion for producing theater to impact social change It was created as an original children's play with music to tell the story of a green sea turtle named Banner, a longtime (actual) resident of the MS Aquarium, and his sea-creature friends who go on a quest to find the Imortal Jelly Fish. The story teaches about the dangers marine animals face due to plastic pollution, oil spills, climate change, and severe weather events. This project was created to address our need to inform and inspire the next generation to help conserve, protect and restore the marine ecosystems to protect our own health, quality of life and survival. As we see society is becoming increasingly more concerned about the influence of human activity on the Gulf's (and the World's Oceans) marine ecosystems.

*Figure 2: Wearable Puppets designed and built by the students of Theatre MSU, with guidance from Puppetry and Effects Master Tim Baker*

The authors sought a way to reach out to large numbers of students and stakeholders to provide a message of hope and imagination to help steer the leaders of tomorrow. Banner: A Sea Turtle Saga was written for elementary school students. The project included original music and lyrics written and produced by Aubrey Hays, Curtis McMurtry, and Diane Burgess, with additional lyrics by Bella Bingham, and large-scale puppetry designs by puppetry and effects master Tim Baker (Figure, 2). This interactive, immersive production engaged the audience in a sea turtle release. Children were also coached in the preshow to create the sounds of a hurricane. At one point in the show a large dark cloth passed over them simulating being underneath an oil spill. Several interesting species of marine life were introduced, such as the Yellow Arrowline Crab, a Dumbo Octopus, The Immortal Jelly Fish and brand new species of Whale, Rice's Whale. The plot of the play emphasized the wonderful and beautiful diversity of marine life while inviting audience members to take better care of our oceans. The "Banner" production was performed as a school show for Theatre MSU with districts bringing classes to MSU's campus for twice daily shows reaching approximately 800 students. An interactive teacher packet designed by MSU students was sent out to all of the schools attending in advance of their seeing the production. Additional community shows were held. Talk backs followed selected productions. Following the MSUshows the project travelled to be performed at the Mississippi Aquarium for an additional 150 guests. While being performed the project was also attended and critiqued by a respondent for the Kennedy Center's American College Theater Festival board who subsequently nominated the show and its creators for the following awards: Allied Design and Technologies Props and Puppets, Lighting Design, Two Irene Ryan

Acting Awards, Sound Design and Four Faculty Certificates of Merit for Playwrighting/Directing, Scenic Design, Technical Direction, and Costuming. Subsequent to the awards and nominations, the project was an invited participant at the Southeastern Theatre Conference, Fringe Theatre Festival in Memphis, Tennessee. The project was also a potential contender for performance at the Kennedy Center's Millennium Stage, however logistics and covid restrictions in place at the time made travel such as that an insurmountable task.

## Outcomes

The two programs, impacted approximately 2500 students and an additional 500 participants including faculty and non-student attendees carrying a message of science and hope to all who participated in the School groups, the Mississippi Aquarium, the Mississippi Theatre Association -Southern Region, Mississippi Theatre Association - Statewide and South Eastern Theatre Conference competitions and conferences, as well as the Kennedy Center KCACTF Awards where the lighting design for "Banner" also won top national honors

## Conclusions

While the benefit of arts integrated STE(A)M learning are clear as indicated by numerous past research models, samples and statistics to accompany this research are to be established in the future utilizing IRB protocols and student population samples to be analyzed in the future. For now arts integrated education, that which incorporates arts into traditional

"core"curriculum systems, is seen to enhance student learning outcomes (Isenberg et al., 2009). The current research has explored the impacts of an arts integrated curriculum using varying methodologies including "quantitative, qualitative, and mixed methodologies". Though there is little evidence to imply a direct link between arts integrated learning and academic success, when viewed through a traditional high-stakes testing lens, evidence does suggest improvement through non-traditional means such as enhanced intuition, intellect, and problem-solving at the student level (Hetland and Winner, 2000).

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