



2018 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES

STEAM - SCIENCE, TECHNOLOGY & ENGINEERING, ARTS, MATHEMATICS & EDUCATION

JUNE 6 - 8, 2018 PRINCE WAIKIKI, HONOLULU, HAWAII

# MAKING STEAM A PRIORITY IN A STEM- ORIENTED SOCIETY: IDEAS FOR AN INNOVATIVE AND INCLUSIVE UNIVERSITY CURRICULUM

MASCOLO-DAVID, ALEXANDRA  
KITCHEN, JENNIFER  
SCHOOL OF MUSIC  
CENTRAL MICHIGAN UNIVERSITY  
MT. PLEASANT, MICHIGAN

Dr. Alexandra Mascolo-David  
Prof. Jennifer Kitchen  
School of Music  
Central Michigan University  
Mt. Pleasant, Michigan

## **Making STEAM a Priority in a STEM-Oriented Society: Ideas for an Innovative and Inclusive University Curriculum**

### **Synopsis:**

An art and a science, music engages the entire brain. We argue that music can serve as a vessel to connect and integrate STEM and STEAM learning. At our institution, we developed and included neuroscience and psychology-based courses in the general education and music curricula; student interest in these classes resulted in high enrollment, frequent offerings, and successful student outcomes. This paper will discuss the benefits reaped from the symbiotic relationship between Arts and Sciences.

Interdisciplinary courses combining music with psychology, neuroscience, and service learning can aid in understanding the symbiotic relationship between the Arts and Sciences and exemplify the importance of a STEAM-oriented education.

## **Making STEAM a Priority in a STEM-Oriented Society: Ideas for an Innovative and Inclusive University Curriculum**

The mission statement from “STEAM not STEM” states:

Much research and data shows that activities like Arts [...] support and foster creativity, which is essential to innovation. Clearly the combination of superior STEM education combined with Arts education (STEAM) should provide us with the education system that offers us the best chance for regaining the innovation leadership essential to the new economy.<sup>1</sup>

As both an art and a science, music has the power to engage the entire brain. Music can therefore serve as a vessel to connect and integrate STEM and STEAM learning. At our institution, Central Michigan University (CMU), neuroscience and psychology-based music courses have been developed and deployed in the General Education and music curriculums. Student interest in these classes has resulted in strong enrollments, frequent offerings, and successful student outcomes. Concepts from neuroscience-based course *Music and the Mind*, psychology-based course *Performance Anxiety Management*, and community service-based course *Music for the Greater Good* have been presented and applied throughout the University and community in workshops, lectures, and in community service projects by faculty and students alike. Upon completion of these classes, students consistently exhibit increased self-awareness, -esteem and -confidence, and gain an understanding for the importance of music as a tool in their personal development.

This paper will discuss the experiences learned and benefits reaped from the symbiotic relationship between Arts and Sciences through the courses we developed and offered on our campus. We hope to provide insight into the value of student learning and will further discuss ideas to showcase the relevance of an accepted and implemented STEAM-oriented education.

---

<sup>1</sup> “STEAM not STEM,” accessed October 8, 2017. [www.steam-notstem.org](http://www.steam-notstem.org)

## Why should we focus on STEAM?

In today's science and technology-focused society, there is a steady need to justify the importance of the Arts and Humanities. Consider music, for instance, and how often it is viewed as entertainment and mainly regarded as an extra-curricular activity. Yet research shows improved learning and development when music and the Arts are incorporated into K-12 school curricula.<sup>2</sup> Furthermore, scientific experiments have repeatedly proven that musicians possess increased neurological connections and enhanced interconnectivity between brain hemispheres, allowing for faster learning and retention of knowledge.<sup>3</sup> Nonetheless, the stigma of music as an extracurricular activity prevails, continuing the cycle of variable funding support in our schools, due to "budget issues" and "prioritizations."

The reticence surrounding a STEAM approach to learning often arises when educators view the "A" as a distraction from STEM programs of study, thus missing the true objective of a STEAM education – integration.<sup>4</sup> According to Susan Riley,

STEAM isn't just an inclusion of the arts – it's an educational approach to learning that uses the arts as an access point for guiding student inquiry, dialogue, and critical thinking. The practice of integrating the Arts with STEM allows students to connect their learning in those critical areas with arts practices, elements, design principles, and standards.<sup>5</sup>

Similarly, Google's Project Aristotle (which represents the company's search for qualities of team effectiveness) has shown that:

[...] the best teams exhibit a range of soft skills: equality, generosity, curiosity toward the ideas of your teammates, empathy, and emotional intelligence. And topping the list: emotional safety. No bullying. To succeed, each and every team

---

<sup>2</sup> "Reinvesting in Arts Education," The President's Committee on the Arts and Humanities, accessed October 8, 2017. <http://www.pcah.gov/resources/re-investing-through-arts-education-winning-americas-future-through-creative-schools>

<sup>3</sup> Ibid.

<sup>4</sup> Susan Riley, "There's Something Missing From STEM Learning," *Education Week* 37, no. 7 (2018): 22.

<sup>5</sup> Ibid.

member must feel confident speaking up and making mistakes. They must know they are being heard.<sup>6</sup>

The Arts teach exactly that: compassion, teamwork, and problem-solving skills necessary for any career.

### STEAM in Higher Education

The need to continue advocating for the inclusion of music and the Arts in daily life and to demonstrate how it fosters a more balanced and well-rounded society prevails in university circles, even across departmental lines. Perhaps, then, change can occur in higher education. Developing an innovative and inclusive music curriculum within the wider university community through courses relevant to student interests will contribute to bridging the gap between Arts and Sciences, and it will lead to increased acceptance of a STEAM-oriented approach for future generations. To this end, in the School of Music at Central Michigan University, we have implemented the following courses: *Music and the Mind*, *Performance Anxiety Management*, and *Music for the Greater Good*.

*Music and the Mind* was initially offered in January of 2015, and it filled to capacity with approximately 30 music majors and minors. Given its immediate success, it was soon added to the General Education University curriculum as a permanent course in the School of Music, thus opening up the enrollment to all students, including non-music majors. The course has since been offered every semester, with multiple sections in some terms. As part of the General Education curriculum at CMU, all disciplines require classes in the Arts. *Music and the Mind* appeals to students of various majors due to its scientific approach. In its current form, the class includes a

---

<sup>6</sup> Cathy N. Davidson, “The surprising thing Google learned about its employees – and what it means for today’s students,” *The Washington Post*, accessed April 26, 2018. [https://www.washingtonpost.com/news/answer-sheet/wp/2017/12/20/the-surprising-thing-google-learned-about-its-employees-and-what-it-means-for-todays-students/?noredirect=on&utm\\_term=.8a8559606d35](https://www.washingtonpost.com/news/answer-sheet/wp/2017/12/20/the-surprising-thing-google-learned-about-its-employees-and-what-it-means-for-todays-students/?noredirect=on&utm_term=.8a8559606d35)

majority of non-music majors from areas such as psychology, neuroscience, communication disorders, biochemistry/pre-med, and occupational therapy, among others.

*Music and the Mind* explores how the various brain systems are engaged by music, and it addresses pertinent questions: What are the cognitive demands of different types of music and different types of musical activities? And how do the auditory, visual, motor, memory, and emotional systems respond to these demands? Students explore how different genres of music affect their daily activities, emotions, and learning through numerous listening and writing assignments. They also read and evaluate experimental articles in music and psychology involving topics such as music and memory, music and emotion, and music and language acquisition.

*Performance Anxiety Management*, a course developed for music majors and minors, also had its first offering in January of 2015. Forty-three students registered in that semester, largely exceeding enrollment expectations. Due to high demand, this course too, joined the permanent School of Music curriculum. Since its inception, the class has witnessed an increased enrollment of business majors (who are dealing with fear of public speaking), and demand for presentations on the topic across campus continues.

*Performance Anxiety Management* emerged from an urgent need to demystify the subject of stage fright – unfortunately still considered taboo amongst some music professionals – and to teach students methods to manage disabling performance anxiety. The course begins with an overview of the anatomy and functions of the brain and the nervous system, followed by an in-depth study of the physical, mental, and emotional symptoms of performance anxiety. Students learn to recognize their own individual symptoms of performance anxiety and are introduced to cognitive and physical exercises to aid in controlling those symptoms. Throughout the semester,

colleagues from the psychology department and the medical school are invited to lecture on the psychological and physical effects of anxiety in the human body. Students read selected articles and book chapters on the subject and hold in-class discussions with peers. Articles containing scientific terminology are discussed with graduate students in the psychology department and/or medical school, with whom students in the class are paired.

*Music for the Greater Good* was created as an Honors program seminar in August of 2017 fulfilling the need for interdisciplinary, hands-on learning experiences for individuals from various academic specialties. Similarly to *Music and the Mind*, students learn to define ways in which music might be an effective tool to aid in learning, motivation, language acquisition, memory loss, and psychological disorders. They explore these topics and others surrounding the cognition and perception of music while emphasizing community engagement.

The ultimate goal of *Music for the Greater Good* is for students to understand the needs surrounding their community and to implement a service-learning project. The current project consists of designing musical elements to incorporate on walking trails of a wellness park adjacent to a local hospital. The wellness park was developed with the intent of providing an outdoor space for hospital employees, family members of patients, patients themselves, as well as community members to embrace a healthier lifestyle. The most recent initiative aims to attract community children, and with that in mind, students in this seminar have decided to build wind chimes and a xylophone-like instrument in an effort to encourage the youth to get outside and be active on the park trails.

### Challenges and Suggestions

Naturally, there are inherent challenges with implementing any new curriculum, but we have encountered unique difficulties associated with the interdisciplinary nature of these courses. For instance, in all three of these classes, getting musicians to think about sciences in a musical context or non-musicians to understand musical concepts in a scientific context has proven to be somewhat of a struggle. This issue arises particularly in relation to scientific readings. Furthermore, from a pedagogical perspective, it is also difficult to balance the strengths and weaknesses of each particular class since the majors of those enrolling in the courses are so widespread. In addition to these content-based difficulties, *Performance Anxiety Management* has some added emotional challenges. Oftentimes, it is difficult for students to feel comfortable communicating their personal struggles to themselves and especially to their peers, though both are necessary to understanding and managing their anxiety.

For those looking to develop a similar interdisciplinary curriculum, we offer the following suggestions to combat potential challenges. Take advantage of collaborative learning environments. This has been essential to facilitating communication between students. Group projects, class discussions, and the reenactment of scientific experiments have also assisted in bridging the gap between students' strengths and weaknesses. Include technology (such as videos and musical examples) to convey the practical application of each topic and aid in complete student understanding. Be flexible in teaching methods in order to best suit the needs of each unique group of students. And, finally, foster a supportive and trusting learning environment, as this is crucial for cultivating conversations that contribute to increased awareness and self-understanding.

## Results



Upon completion of these courses, we have noticed a pattern of results: music students learn to talk about music in ways that their non-musician peers can comprehend, and those with a science background are able to explain scientific concepts in an approachable manner. In the interdisciplinary courses of *Music and the Mind* and *Music for the Greater Good*, students acquire complete understanding of music as a tool in their personal development. Some have applied course concepts to their professions and have learned the importance of working cooperatively with the community.

Final projects and papers have focused on meaningful topics: for instance, one student chose to research the benefits of using music in gait training therapy as part of the care routine for Parkinson's disease patients. This particular individual is a neuroscience major who works in a nursing home. Many of the residents that she works with suffer from Parkinson's disease, and she now plans to include music in their daily routine. Others were inspired to volunteer in memory care facilities in our community after taking these courses. They chose to spend time with Alzheimer's patients using familiar music to improve their cognitive facilities and overall mood, following the mission of the Music and Memory Foundation – to “help people in nursing homes and other care organizations who suffer from a wide range of cognitive and physical challenges to find renewed meaning and connection in their lives through the gift of personalized music.”<sup>7</sup> A recent letter from a former student expressed her gratitude for the course after learning of her grandmother's diagnosis with Alzheimer's disease. She now experiences first-hand how music can be a positive enhancement to her grandmother's care.

From the psychological aspects of *Performance Anxiety Management*, students consistently exhibit increased self-confidence in public performances, and demonstrate higher

---

<sup>7</sup> “Music and Memory,” accessed April 27, 2018. <https://musicandmemory.org/>

levels of self-awareness and self-esteem. Several stated how the class taught them to transform fear into excitement. Others learned to detach their self-worth as human beings from their performances. One particular individual raved about how she was able to stop taking anxiety medication prior to performances. But the most touching account came from a young lady who claimed that the class dramatically changed her life for the better, as it gradually provided her with the strength and self-esteem needed to lose tens of pounds of extra weight, giving her renewed self-confidence in every aspect of her life.

While these student results are tremendously important, the benefits to us faculty members have been equally relevant. Collaborations with colleagues and community members in the areas of communication disorders, psychology, neuroscience, biosciences, medicine, business, and the Honors program, have contributed to our growth as educators and scholars, and to our forming lasting relationships with students and faculty across campus. We are motivated to continue using our knowledge and talent as musicians to further the University at-large, the community, and the discipline.

### Conclusions

Steve Jobs famously stated: “Technology alone is not enough. It’s technology married with the liberal arts, married with the humanities, that yields the results that makes our hearts sing.”<sup>8</sup> Through the offering of the three aforementioned courses, we hope to form stronger and lasting interdisciplinary relationships, to promote further interest in developing and implementing additional STEAM courses across campus, and to witness our service-learning

---

<sup>8</sup> Horace Dediu, “Steve Jobs’s Ultimate Lesson for Companies,” *The Harvard Business Review*, accessed April 26, 2018. <https://hbr.org/2011/08/steve-jobss-ultimate-lesson-fo>

relationship with community partners grow and expand; we anticipate our students will continue to showcase the benefits of music courses in the General Education curriculum through the presentation of research projects, conference participation, and practical application; we aim to create an environment for music-making that promotes increased psychological and physical health and well-being; and, we hope to provide guidance to educators and future educators in their development of interdisciplinary STEAM-based courses. Ultimately, we strongly advocate for STEAM as an indisputable way of learning and living.

#### Sources

Davidson, Cathy N. “The surprising thing Google learned about its employees – and what it means for today’s students.” *The Washington Post*. Accessed April 26, 2018.

[https://www.washingtonpost.com/news/answer-sheet/wp/2017/12/20/the-surprising-thing-google-learned-about-its-employees-and-what-it-means-for-todays-students/?noredirect=on&utm\\_term=.8a8559606d35](https://www.washingtonpost.com/news/answer-sheet/wp/2017/12/20/the-surprising-thing-google-learned-about-its-employees-and-what-it-means-for-todays-students/?noredirect=on&utm_term=.8a8559606d35)

Dediu, Horace. “Steve Jobs’s Ultimate Lesson for Companies.” *The Harvard Business Review*. Accessed April 26, 2018. <https://hbr.org/2011/08/steve-jobss-ultimate-lesson-fo>

“Music and Memory.” Accessed April 27, 2018. <https://musicandmemory.org/>

“Reinvesting in Arts Education.” The President’s Committee on the Arts and Humanities. Accessed October 8, 2017. <http://www.pcah.gov/resources/re-investing-through-arts-educationwinning-americas-future-through-creative-schools>

Riley, Susan. “There’s Something Missing From STEM Learning.” *Education Week* 37, no. 7 (2018): 22.

“STEAM not STEM.” Accessed October 8, 2017. [www.steam-notstem.org](http://www.steam-notstem.org)

“STEM to STEAM.” Accessed October 8, 2017. [www.stemtosteam.org](http://www.stemtosteam.org)

“Turnaround Arts Initiative Summary of Key Findings.” Accessed October 8, 2017. [https://www.pcah.gov/sites/default/files/Turnaround%20Arts%20Phase%201%20Final%20Evaluation\\_Summary.pdf](https://www.pcah.gov/sites/default/files/Turnaround%20Arts%20Phase%201%20Final%20Evaluation_Summary.pdf)