SUPPORTING THE 21st CENTURY EFFECTS
OF MUSIC PERFORMANCE WITH TECHNOLOGY

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21st Century skills and Authentic Assessment are important parts of the educational scope today (Huysken, Olivey, McElmurry, Gao & Avis, 2019). Educators are working towards teaching new skills that include collaboration, critical thinking, flexibility, creativity, problem solving, and a greater understanding of technology and media. Currently, they are preparing students for future employment and to be competitive in the modern world. The challenge at this time in history is that things are moving and developing so quickly we are preparing students for jobs that have yet to be created (Robinson, 2010). If the specific options are unknown for students in the future then the best option would be to teach them to be creative problem-solvers who possess the strategies to teach themselves what they need when they need it, and how to properly utilize technology in their innovative work. Learning tasks in education are no longer isolated to have students produce one right answer. Instead of focusing our curricula on facts and traditional testing the trend has moved more towards Authentic Assessment through Project Based Learning, and teaching 21st Century skills.

One strong quality of teaching music performance to students is that it has the ability to address various learning styles of individuals, while incorporating multiple intelligences in the process. Students participating in the average music performance class incorporates six of the eight areas identified by Howard Gardener (1983) in his Theory of Multiple Intelligences: Linguistic, Logical-mathematical, Bodily-kinesthetic, Interpersonal, Intrapersonal, and of course Musical-auditory. Smith (2008) refers to Gardner's theory, stating that seven kinds of intelligence would allow seven ways to teach, rather than one. Therefore, powerful constraints that exist in the mind can be

mobilized to introduce a particular concept (or whole system of thinking) in a way that

children are most likely to learn it and least likely to distort it (Smith, 2008). Layering

and scaffolding naturally occur which helps reinforce lessons taught in this type of

setting, ultimately providing a strong sense of content reinforcement for students.

　　　Musical performance study is unique not only for this reason, but because it also

relies on a performance-based assessment utilizing all of these intelligences at the same

time. This aligns with the educational learning theory known as authentic assessment.

Authentic assessment is a form of assessment in which students are asked to perform

real-world tasks that demonstrate meaningful application of essential knowledge and

skills (Mueller 2011). It is often described as a performance-based assessment, because

students are required to learn the information to a level of mastery where they can

complete a normal task or project using the skills they have been developing. This has

become a new and exciting trend in the education world over the past two decades,

piquing interest and challenging educators everywhere to find more effective ways to

provoke a more complete product from their students' efforts, ultimately honing their

real-world abilities.

　　　The beauty of how music instruction works is that it is intrinsically performance

based, and naturally develops many of the 21st Century skills that educators are working

to instill in their students. The process is inherently "authentic", because these skills

being honed are based on utilization and mastery, and will only work if students are able

to put their knowledgeable achievement into practice. Students are taught a variety of

technical and specific skills that they need to know to be a successful musician. Often,

traditional assessments are used to test terms, or the theoretical aspect of what is being

performed, but this style of assessment only tests proficiency to a certain degree. Many

times with traditional assessment, students have memorized the topics discussed in class,

but have little if any working knowledge of that material.

Music teachers cannot give their students a traditional test and have their class

achieve a perfect score, then expect to be ready to perform a concert. Music educators

have to assess the performance and ability level through authentic assessment to see if

their students will know how to apply what they have learned in class to their personal

practice. Music is a subject area that relies on scaffolding year after year and develops

into a unique skill that can be used at any time, in any country, with a variety of

instruments or musicians well after they have left the classroom.

It is often difficult for musical study to fit into the world of core curriculum

subjects. Until recently the core academic learning culture has been based upon

traditional assessments. Tests in music are the concerts, compositions, or recordings, all

project-based products evidencing students' ability to learn and master the subject

material. These are all inherently measured through authentic assessments or

performance assessments, and have been for centuries. It is only recently in the world of

21st Century education that music is gaining the respect and inclusion among other areas

of high importance.

<u>STEM to STEAM</u>

In the mid part of the 20ᵗʰ Century the emerging theme in the workforce was the

need for science, technology, engineering, and math skills. This developed into what we

commonly call STEM education. The concept behind combining these skill sets was that

a more competent and efficient workforce made up of individuals who would develop

economic growth and leadership could be produced. Additionally, an attractive feature of this field was the ability to earn a higher salary. Individuals with a STEM degree will earn more in a lifetime than those with a liberal arts degree (Reitenback, 2015), which is an attractive feature of this field.

STEM learning drives concepts of critical thinking and innovation, which were the new focus in the 20ᵗʰ Century education debate. This was directly tied to enhancing the economy, and non-arts-based education became associated with innovation (Liao, 2016). As this model developed there were many successes, but also some drawbacks that came to light. The innovation created was not easily introduced to the consumer world. Proper communication among STEM team members was difficult to foster. To help remedy this challenge, MIT had to develop a book entitled *Learning to Communicate in Science and Engineering* to help foster better communications across the board to prepare those working in the STEM field (Reitenback, 2015).

As the 21ˢᵗ Century quickly approached the need for an updated version of STEM became more apparent. STEM was based on convergent thinking where people needed to produce the correct answer as their main goal. They were now approaching a time where they needed more of a divergent and creative approach to innovating (Land, 2013). This course of thought allowed for the exploration of many ways of thinking to eventually produce a more creative means of solving the problem correctly. Additionally, at this time students were not pursuing education in the STEM field due to intimidation of the subject matter and lack of interest. This was a concern because the STEM field world-wide was growing at three-times the rate of the rest of the economy, and only 4.4% of

American undergraduates were pursuing the field. This was creating a shortage of highly

qualified technology workers in the STEM field (Land, 2013).

Due to this necessity the STEM model included the arts to their innovation which

formed the 21st Century field of Science, Technology, Engineering, Arts, and Math

(STEAM). The arts easily help with visual design, but also with the way teams

communicate and think. Individuals with an arts background are considered risk-takers

and are able to problem solve with greater effectiveness (Robelen, 2011). It does not end

with the visual arts, but specifically includes unique skills brought to the table by

musicians. From studying music, musicians have highly developed hand-eye

coordination and are capable of interpreting multiple data fields simultaneously. They

are also known for having the ability to learn quickly and problem-solve in a variety of

settings (Reitenbach, 2015). Great innovators in history were artists and musicians such

as Albert Einstein (violinist), Steve Jobs (guitarist), and Leonardo da Vinci (painter)

(Robelen, 2011). This shift in thinking solved many issues in the STEM field and is

working toward helping our nation stay economically competitive.

An employee with a diverse background can achieve more success in their

career. This example has been evidenced by gender diversity in the workforce driving

stronger economic results (Reitenback, 2015). Diversity within the field drives quality

innovation with a variety of skills and perspectives to draw from, as opposed to relying

on one facet of the population to produce. It is not enough though to encourage students

to pursue a challenging field of study to support the growing need for qualified STEAM

professionals. Students need to be attracted naturally to this type of learning, and

developing an arts-centered learning environment is one way innovative schools are

teaching cross-curricular creativity (Hunter-Doniger, 2018).

<p align="center">STEAM Education Initiatives in Schools</p>

Schools that prioritize arts education as the basis for functional education are in

direct support of the success of developing minds for future STEAM employment. As

they develop creative thinking and problem-solving skills through project-based learning

to solve social issues in a transdisciplinary space (Guyotte, 2014) they will be able to

more effectively retain and comprehend non-arts subject matter (Liao, 2016). In order

for this model to work properly, strict guidelines must be implemented on a school-wide

level. They should include valuing each area of STEAM, both arts and non-arts domains,

with rigor and equality across the curriculum. Then be sure to implement a wide variety

of approaches, as well as encouraging creativity, collaboration, and innovative thinking

(Hunter-Doniger, 2018).

Maintaining these criteria with integrity throughout the school promotes interest

in learning and more effective engagement in cross-curricular subject matter for

students. This concept was recognized by the federal government in 2015 when

President Obama signed the "Every Student Succeeds Act for Arts and Students"

(Hunter-Doniger, 2018). Successful learning environments have arts and non-arts

workspaces and subject matter combined for better communication and collaboration

among students, as well as teachers from different disciplines.

There is always a percentage of students who excel in the traditional classroom

model--listening, taking notes, studying, and finally recalling information for the

test. What happens to those who do not fit into that model because they learn differently?

With authentic assessment, students have a constructivist role empowering them to take

ownership in their education by choosing the medium that is right for them to showcase

their knowledge. The same skills are being demonstrated and students have a choice to

be assessed on something at which they are not only proficient, but also confident.

Currently the only students who engage in music classes are those who sing or

play an instrument; therefore, only a small representation of the high school population is

exposed to this unique way of learning considering the scheduling conflicts, financial

constraints, and issues of interest that prevent the entire student population from choosing

music as their elective (Baker, 2009). Integration of technology into the music class

means more students could become attracted to and engaged in arts education. The field

of music includes careers that range far beyond the performance of an instrument, and

these days, deeply into the field of technology. Students could be learning one more

important life skill in the area of technology to take with them outside their music class:

> The last few decades have belonged to a certain kind of person with a
> certain kind of mind – computer programmers who could crack code,
> lawyers who could craft contracts, MBA's who could crunch numbers.
> But the keys to the kingdom are changing hands. The future belongs to a
> very different kind of person with a different kind of mind – creators and
> empathizers, pattern recognizers, and meaning makers. These people are
> artists, inventors, designers, storytellers, caregivers, consolers, big picture
> thinkers – will now reap society's richest rewards and share its greatest
> joys (Pink, 2005, p. 10).

Music, with the proper integration of technology, has the potential to transcend

the world of periphery subjects and offer exposure to the powerful development of 21st

Century skills useful in contemporary education and the globalized workforce for

students who choose this course of study.

Infusing Technology

21st Century developments are happening in every industry, including music

education. Harnessing these innovations gives us the opportunity to enhance our

students' ability to learn, as well as attract new students to studying music. For example,

it is not uncommon to use industry-related software and hardware in a high school music

program. Recording and notation software, computer stations with keyboards for

composition and theory stations, notation software, and GarageBand (Demski, 2010) are

a few examples of technology that not only catch students' interest, but offer them real-

world training that applies directly to the field. They contribute to the enhancement of

aural comprehension skills and speeds up the learning curve for students developing this

type of ear training. Students new to music can begin to develop confidence as they

develop their creativity in creating new sounds and compositions (Gouzouasis, 2004).

Although ensemble rehearsals occur in person, distance learning is a strong

consideration for the music classroom. Where a student would spend large amounts of

time practicing his or her parts independently outside of rehearsals, there are tools

available to them not only to keep them connected to the classroom experience but also

help make their practice time more efficient. With innovations such as Google

Classroom, Edmoto, Microsoft Classroom, Prezi, YouTube, and Edublogs students can

share practice materials, personal progress videos, and information about the music they

are learning. Many of these are free or low-cost solutions supporting free accessibility

for a variety of students.

Compiling resources on these collaborative spaces allows them to help one

another with their musical development, while practicing technology skills they can use

later on in life. The impact that distance learning and social media have in music

education offers opportunities to keep an ensemble operating at their personal best both

in and outside of rehearsal or class time (Albert, 2015). The teacher's role lies in the

smooth facilitation of technological use and communication:

> By having a thorough knowledge of the identified technological practice
> teachers are able to use on-going formative assessment opportunities
> throughout a student's practice to give student quality feedback that will
> enhance their learning about relevant technological processes and tech-
> niques. This will empower students to make design and process decisions
> that will increase their likelihood of producing successful solutions (Fox-
> Turnbull, 2006, p. 75).

In addition to performance, culture, and history, high school band teaches

responsibility, professionalism, and accountability. Many high school bands create their

own handbook and leadership program, where more experienced students help in areas of

academics, and musical preparation (Hayden & Romines, 2015). These students often

collaborate on the development of these types of materials with each other and younger

students through the use of online share points such as PB Works, Dabble, GoogleDocs,

or Wikispaces. Reinforcing a collaborative process within a classroom environment

continues to provide practice on utilizing 21st Century skills. This also helps support and

welcome newcomers as they enter this community of practice and acclimate themselves

to the culture of the ensemble, making their ability to settle in and participate in social

learning an additional attribute of the 21st Century music learning experience (Wenger,

2000).

Innovation in the world of apps continue to give us endless options to support

music students. Apps that connect us to mobile learning platforms, metronomes, tuners,

in addition to those that serve as a reference or a practice platform for music theory, ear

training, or music history are just some of the many that are accessible to students

today. Recording apps are helpful in aiding students to record practice sessions for

performance tests and auditions. Other innovations help support students with low-cost

solutions to necessary, and often costly, equipment. For example, strobe tuners are visual

tuners that use color blocks moving at various speeds to show the intonation of an

instrument. They were once priced at upwards of $100, but now students can download

this visual tuning aid on their devices for under $20. Considering the advancements of

technology we do not have to abandon the practices we use in music education, but

instead embrace and infuse new and exciting media to help our students achieve their best

(Thibeault, 2014).

<div align="center">Conclusion</div>

Music is currently being incorporated into the 21st Century world of STEAM

education along with other aspects of the arts, replacing the 20th Century concept of

STEM. Through proper integration in music performance education, coupled with

authentic assessment and other forms of project-based learning, not only will we prepare

our music performance students to be competitive in the 21st Century, but we will also be

able to attract other students to learn through this unique educational model. Confidence

in these cross disciplines fosters stronger collaboration, creativity, and innovation,

through divergent thinking. These skills are imperative to students' survival and success

in the modern world. Some schools are beginning to implement an arts-focused learning

environment to help foster this type of education while addressing a variety of learning

styles, and allowing students to explore their potential through creative development

(Hunter-Doniger, 2018).

This innovation in 21st Century learning gains continued support from the music performance ensembles where students learn through project based learning and authentic assessment. The nature of this course of study addresses all types of learners with proper modifications by brining them together to work towards a common outcome, usually a concert performance. It is through this experience that students rely on a variety of non-verbal communication, listening skills, and personal adjustments to collectively create the musical outcomes striving for a professional interpretation in their performance. This type of discipline develops risk-taking skills that support trial and error and collaboration to develop the desired outcome, much like the expectations of modern problem solving.

Although accessibility to certain forms of technology in the high school music classroom were met with limitations due to cost and training, with the growing advances in technology music students have better accessibility to apps and affordable programs that can enhance their growth. The affordability of these simple electronic musical aides is supporting additional equity among all music students in furthering their personal performance achievements. Hopefully in time there will be data to show more even integration across school districts, ultimately supporting the development of the arts in 21st Century educational landscape.

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